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FUGRO NATIONAL INC LONG BEACH CA
MX SITING INVESTIGATION. GEOTECHNICAL EVALUATION OF LUKE BOMBIN-ETC(U)
JAN 78

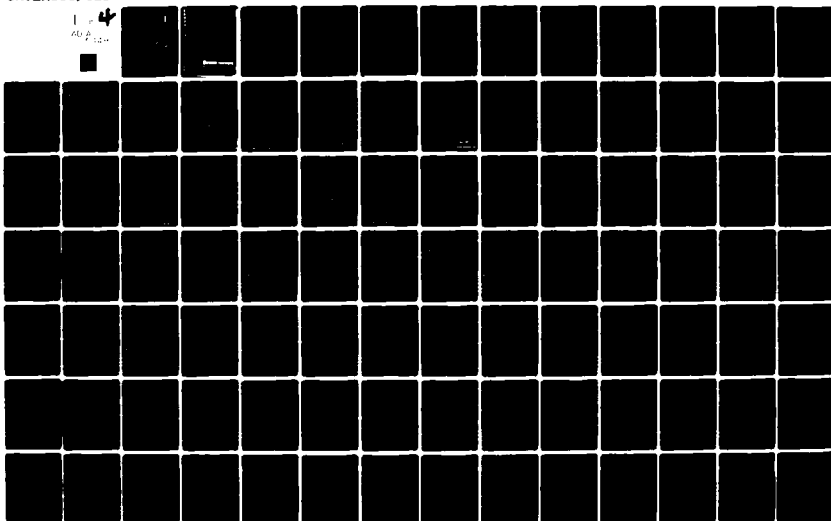
F/S 8/7

FO4704-77-ç-0010

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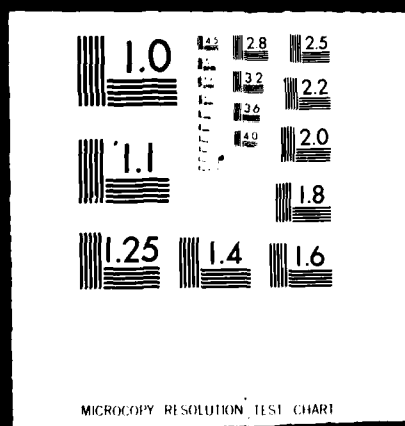
UNCLASSIFIED FN-TR-19D-VOL-2-APP-A

1 4
462



1 OF 4

AD A
113 448



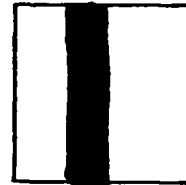
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FN-TR-19D, Vol. II, Appendix A

DOCUMENT IDENTIFICATION

Final

Contract F04704-77-C-0010 20 Jan 78

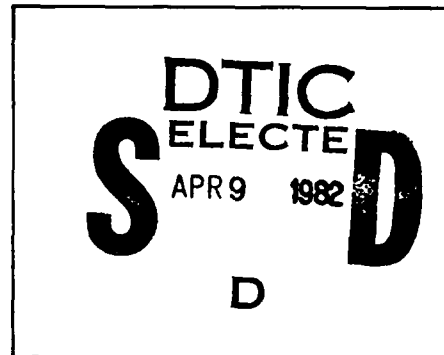
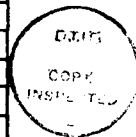
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MX SITING INVESTIGATION
GEOTECHNICAL EVALUATION OF
LUKE BOMBING AND GUNNERY RANGE
GEOTECHNICAL REPORT
LECHUGUILLA DESERT, ARIZONA
VOLUME II
APPENDIX A

Prepared for:

Space and Missile Systems Organization (SAMSO)
Norton Air Force Base, California

Prepared by:

Fugro National, Inc.
3777 Long Beach Boulevard
Long Beach, California 90807

20 January 1978

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER FN-TR-190-II	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Geotechnical Evaluation of Luke Bombing + Gunnery Range Geotechnical Report Lechuquilla Desert, Ariz. Vol. II Appendix A		5. TYPE OF REPORT & PERIOD COVERED Final
7. AUTHOR(s) Fugro National		6. PERFORMING ORG. REPORT NUMBER FN-TR-190-II
9. PERFORMING ORGANIZATION NAME AND ADDRESS Ertec Western Inc. (formerly Fugro National) P.O. Box 7765 Long Beach Ca 90807		8. CONTRACT OR GRANT NUMBER(s) F64704-77.C-0010
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Department of the Air Force Space and Missile Systems Organization Wright AFB PA 192409 (SAMSO)		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 64312 F
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE 20 Jan 78
		13. NUMBER OF PAGES
		15. SECURITY CLASS. (of this report) -
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Distribution Unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) Distribution Unlimited		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) velocity profile, transverse valley, longitudinal valley, downhole velocity data, Nuclear Geophysical logs, gravity, seismic refraction survey, magnetic, rough gravity, etc.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) M-X Siting Investigation Report, Geotechnical Evaluation of Luke AFB Bombing and Gunnery Range, Lechuquilla Desert, Arizona. Report includes data on Seismic Refraction Survey, Gravity and Magnetic, Downhole Velocity Data (Log of Boring) and Nuclear Geophysical Logs.		

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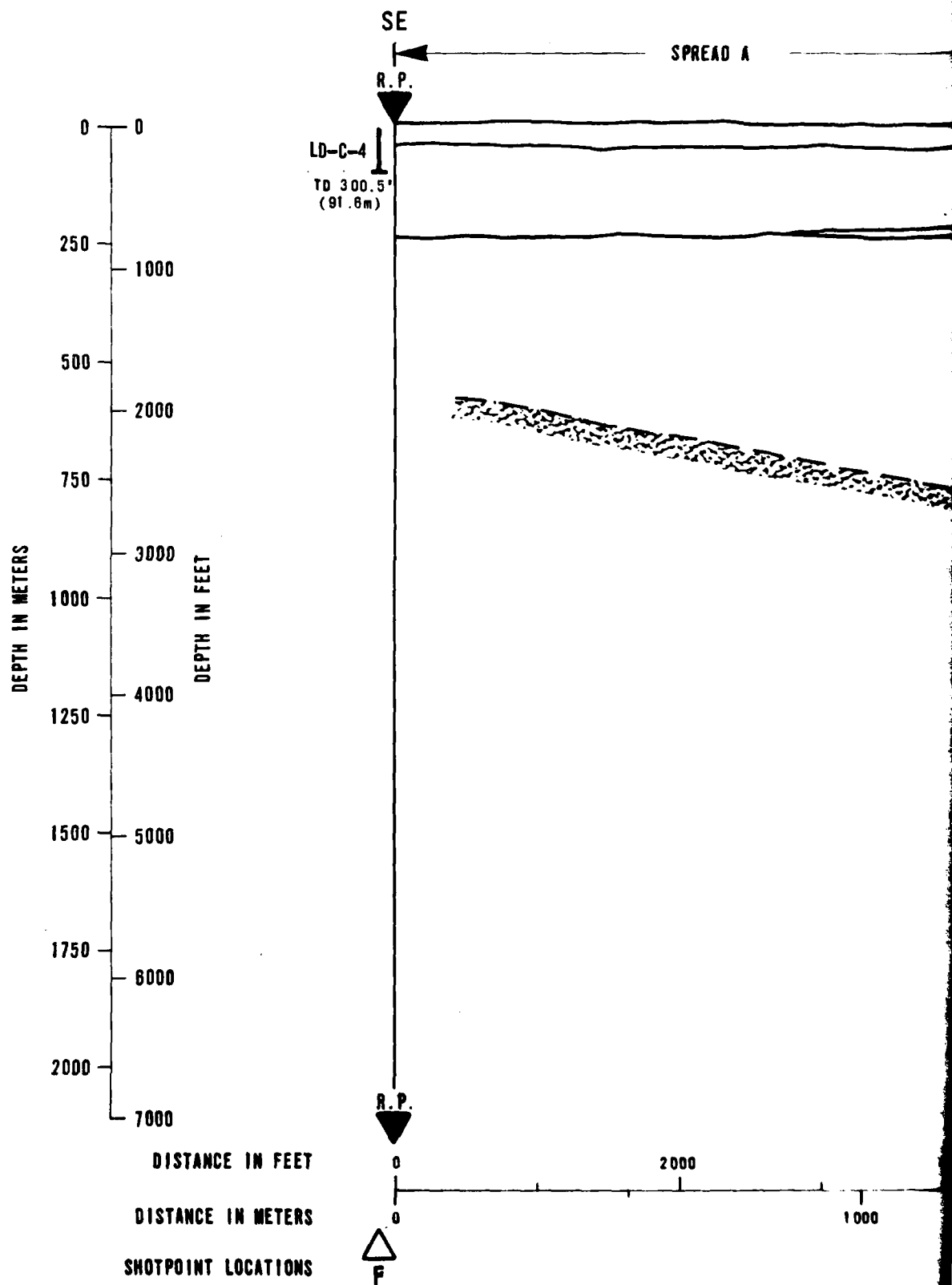
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SPREAD B

SPREAD C

2900-3200 ft sec (880-980 m/sec)

3500-3900 ft sec (1070-1190 m/sec)

6900-7200 ft sec (2100-2190 m/sec)

13000-14800 ft sec (3960-4510 m/sec)

ASSUMED BASEMENT VELOCITY 16500 ft/sec (5030 m/sec)

6000

6000

10000

12000

2000

3000

4000



VELOCITY PROFILE SEISMIC REFRACTION LINE LD-DS-1

N 25 W



SPREAD D

INTERSECT
LD-DS-2

GROUND SURFACE

SPREAD E

LD-D-1

2900-3200 ft/sec (880-980 m/sec)

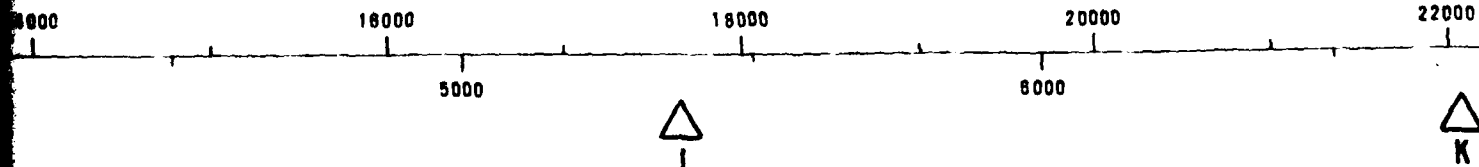
3500-3900 ft/sec (1070-1190 m/sec)

6900-7200 ft/sec (2100-2190 m/sec)

TD 840'
(256m)

9700 ft/sec (2960 m/sec)

13000-14800 ft/sec (3960-4510 m/sec)



SPREAD AA

SPREAD BB

2900-3200 ft/sec (880-980 m/sec)

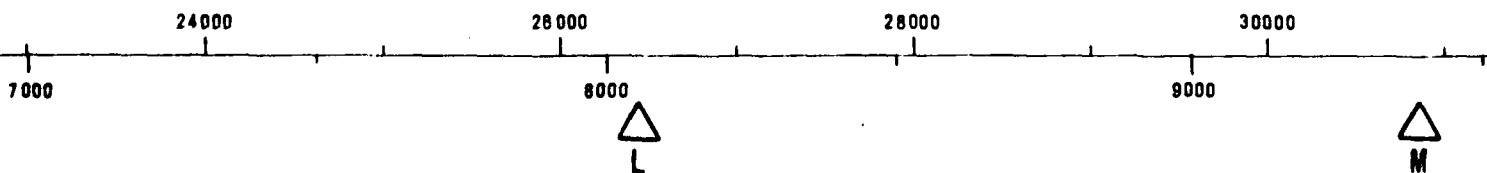
3500-3900 ft/sec (1070-1190 m/sec)

6900-7200 ft/sec (2100-2190 m/sec)

9700 ft/sec (2960 m/sec)

13000-14800 ft/sec (3960-4510 m/sec)

ASSUMED BASEMENT VELOCITY 16500 ft/sec (5030 m/sec)



SPREAD CC

NW

R.P.

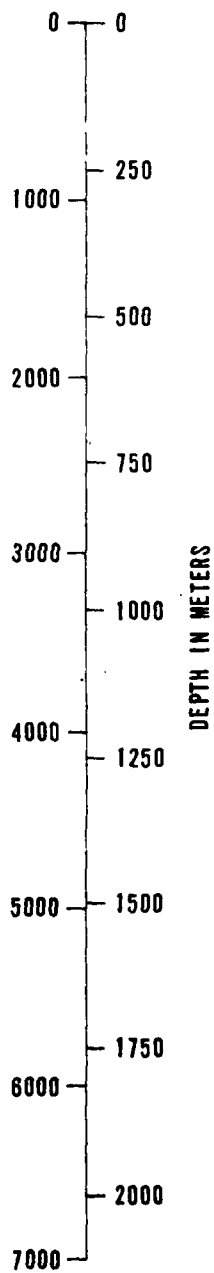


Reference point on the ground surface used as the zero datum on the depth scale.

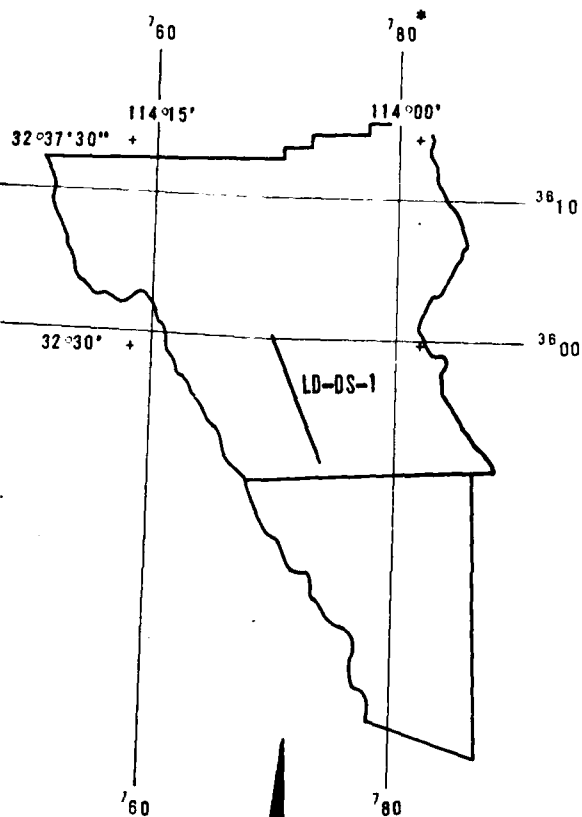
32000

34000

10000



LOCATION MAP



1:500,000



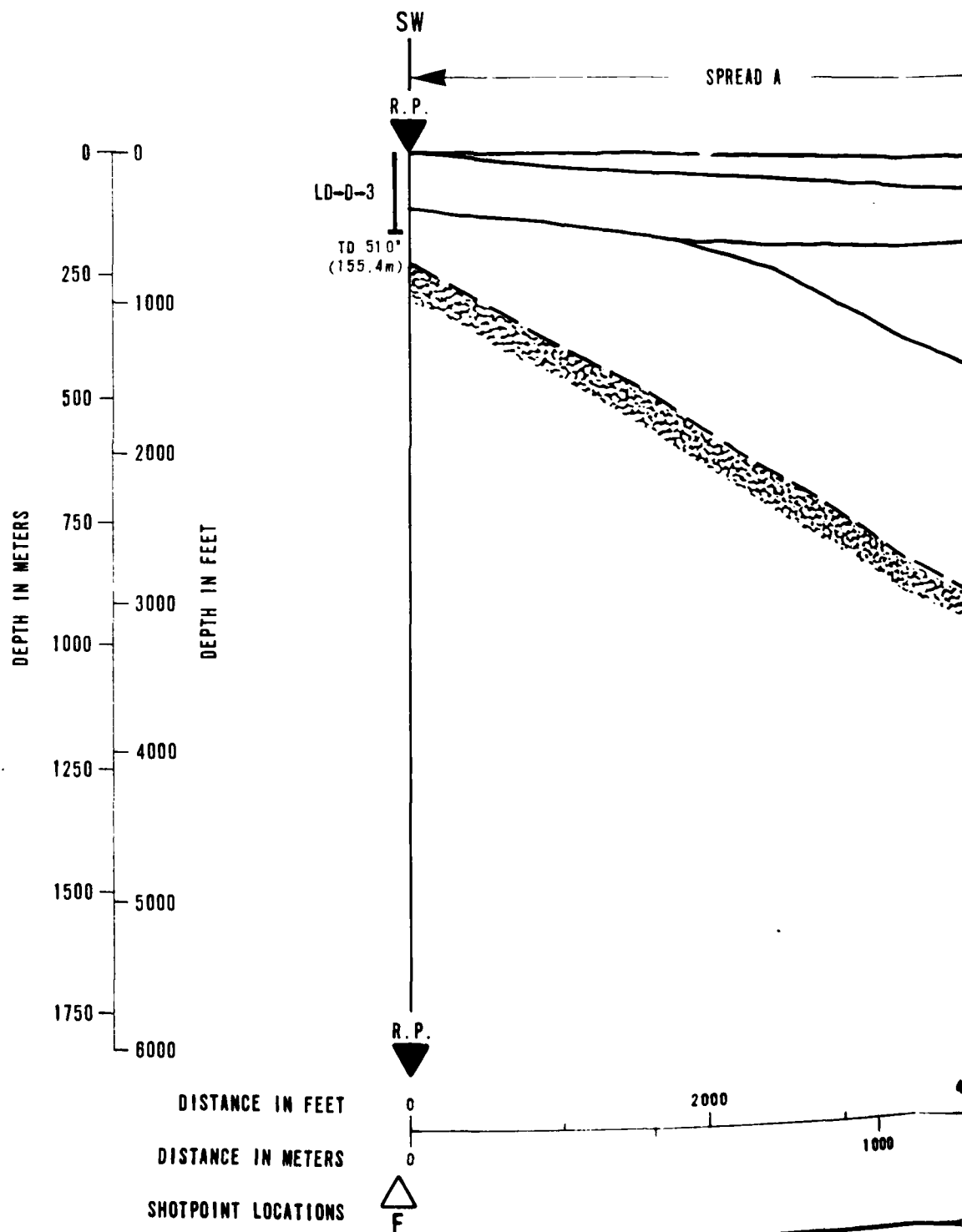
**VELOCITY PROFILE LD-DS-1
VALLEY SEISMIC REFRACTION SURVEY
LECHUGUILLA DESERT, ARIZONA**

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMS0

FIGURE
A-1

FUGRO NATIONAL, INC.

*NOTE: See Appendix page C-5 for explanation Universal Transverse Mercator Grid System.



VEL
SEISMIC REF



SPREAD B



SPREAD C

INTERSECT LD-DS-1

2650 ft/sec (808 m/sec)

4500-5000 ft/sec (1372-1524 m/sec)

7400-7500 ft/sec (2256-2286 m/sec)

12600-14400 ft/sec (3840-4389 m/sec)

ASSUMED BASEMENT VELOCITY 16500 ft/sec (5030 m/sec)

4000

6000

8000

10000

12000

2000

3000



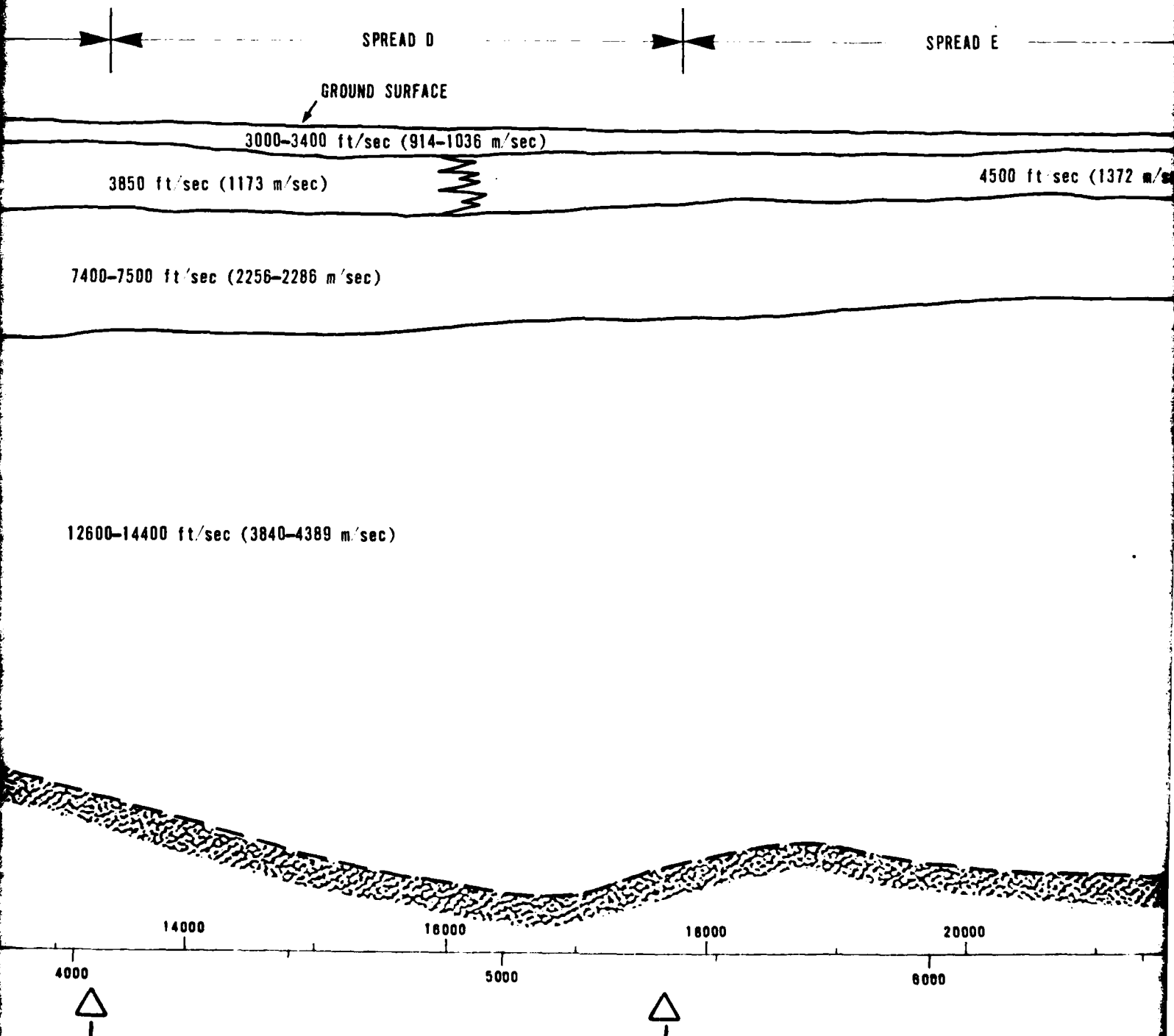
1

2

VELOCITY PROFILE

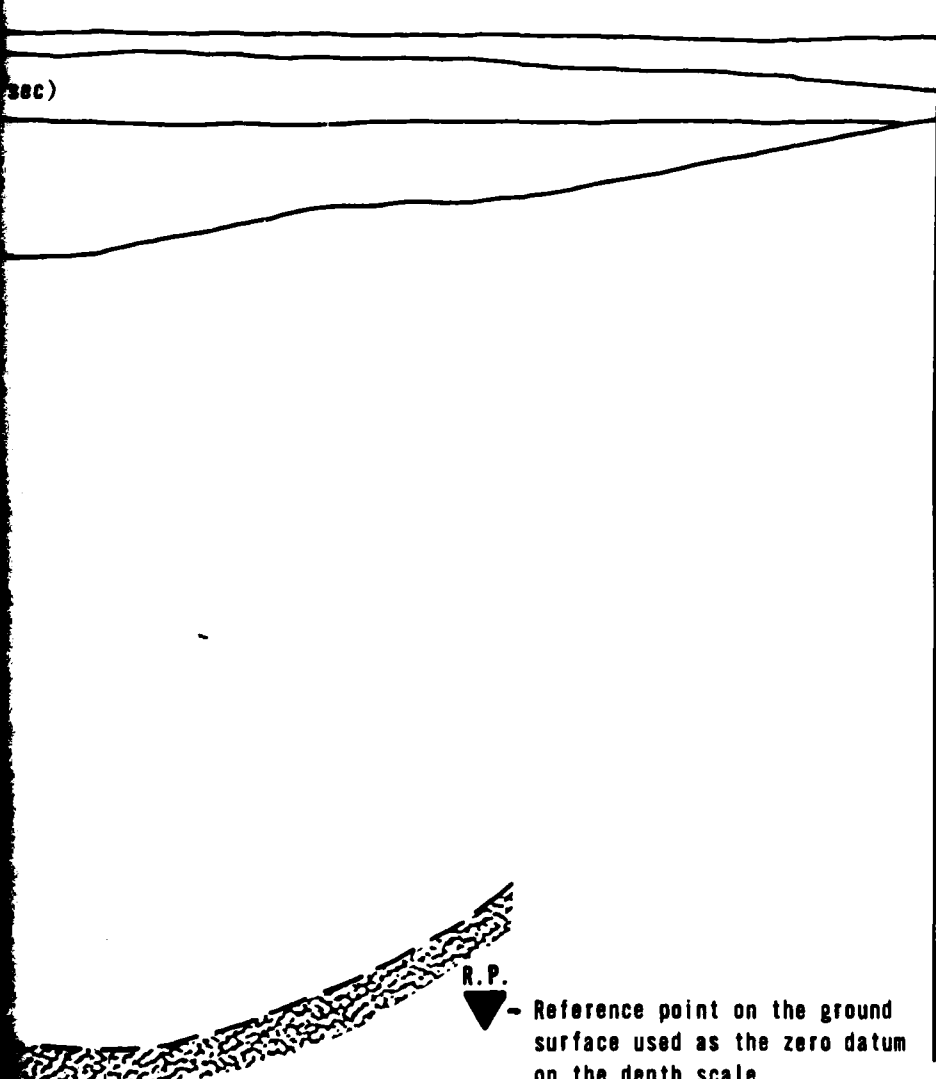
REFRACTION LINE LD-DS-2

N 40 E



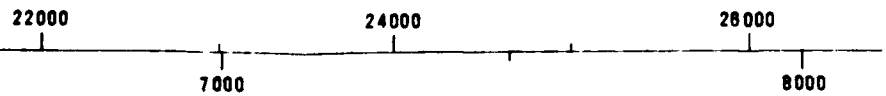
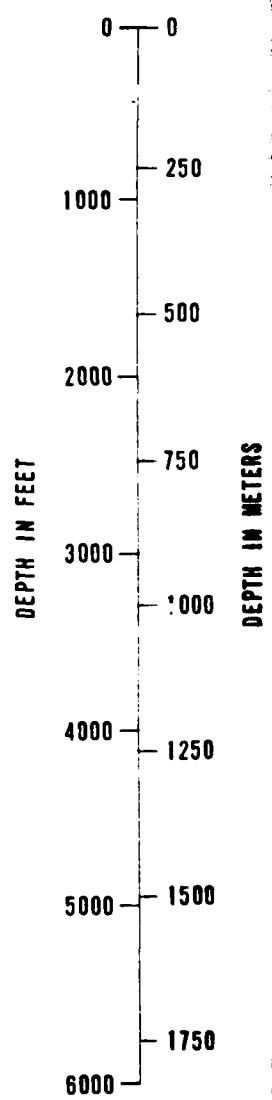


sec)



R.P.

Reference point on the ground surface used as the zero datum on the depth scale.

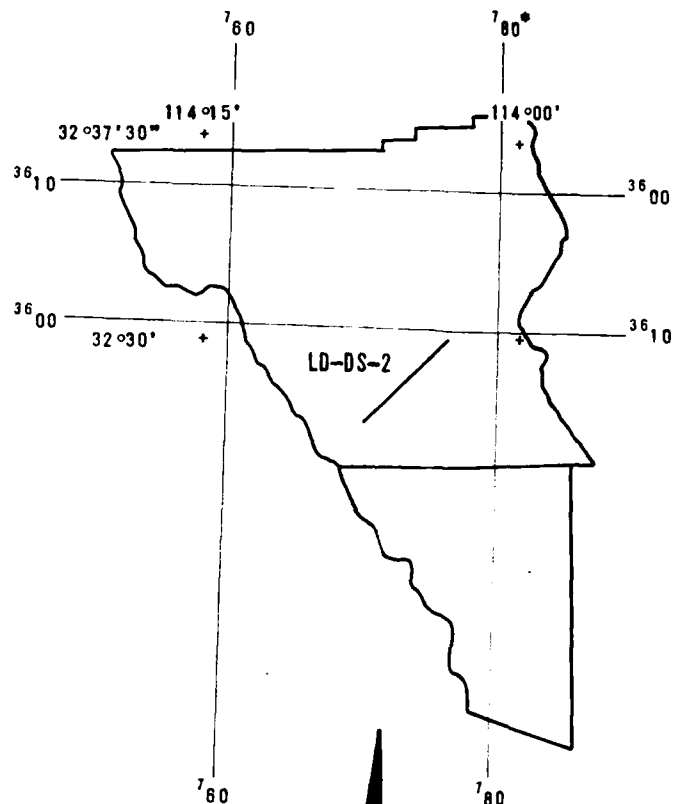


K

L

11

LOCATION MAP



1:500,000



*NOTE: See Appendix page C-5 for explanation of Universal Transverse Mercator Grid System.

DEPA

**VELOCITY PROFILE ED-08-2
VALLEY SEISMIC REFRACTION SURVEY
LECHONILLA DESERT, ARIZONA**

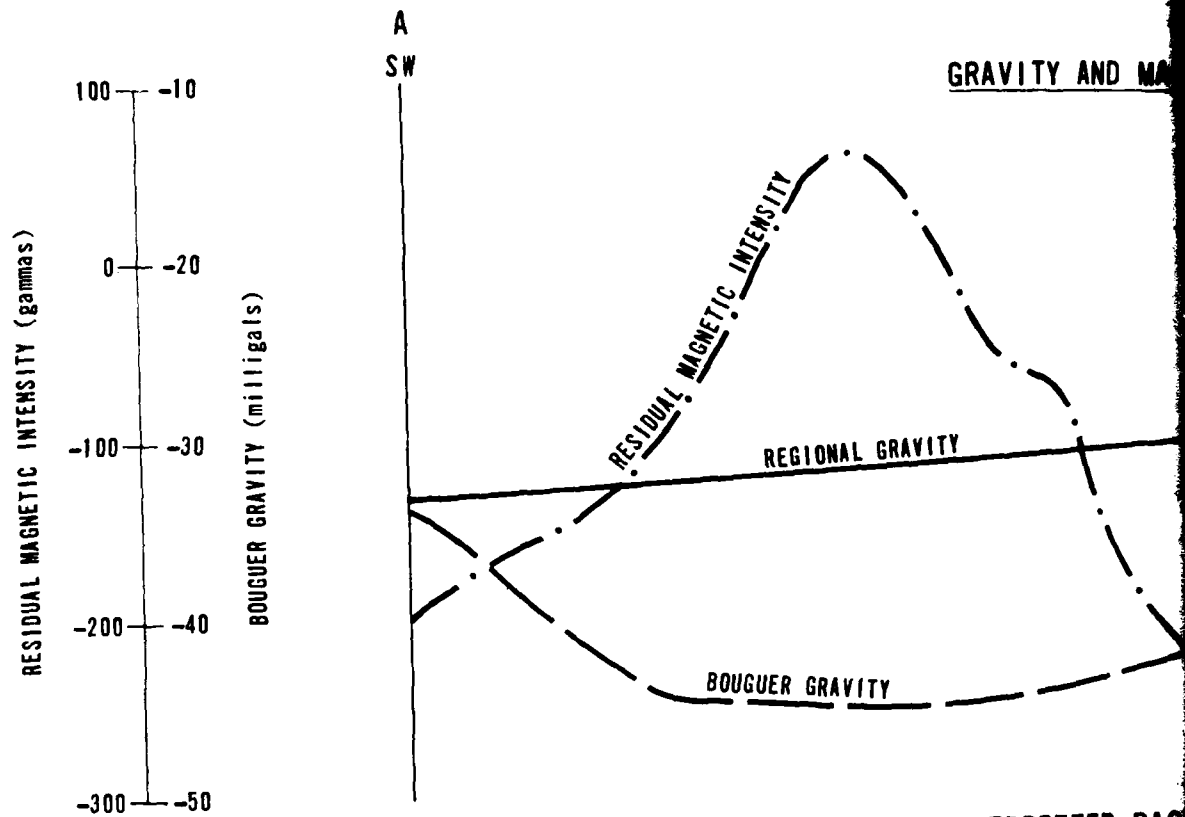
**MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SANSO**

**FIGURE
A-2**

FURRO NATIONAL, INC.

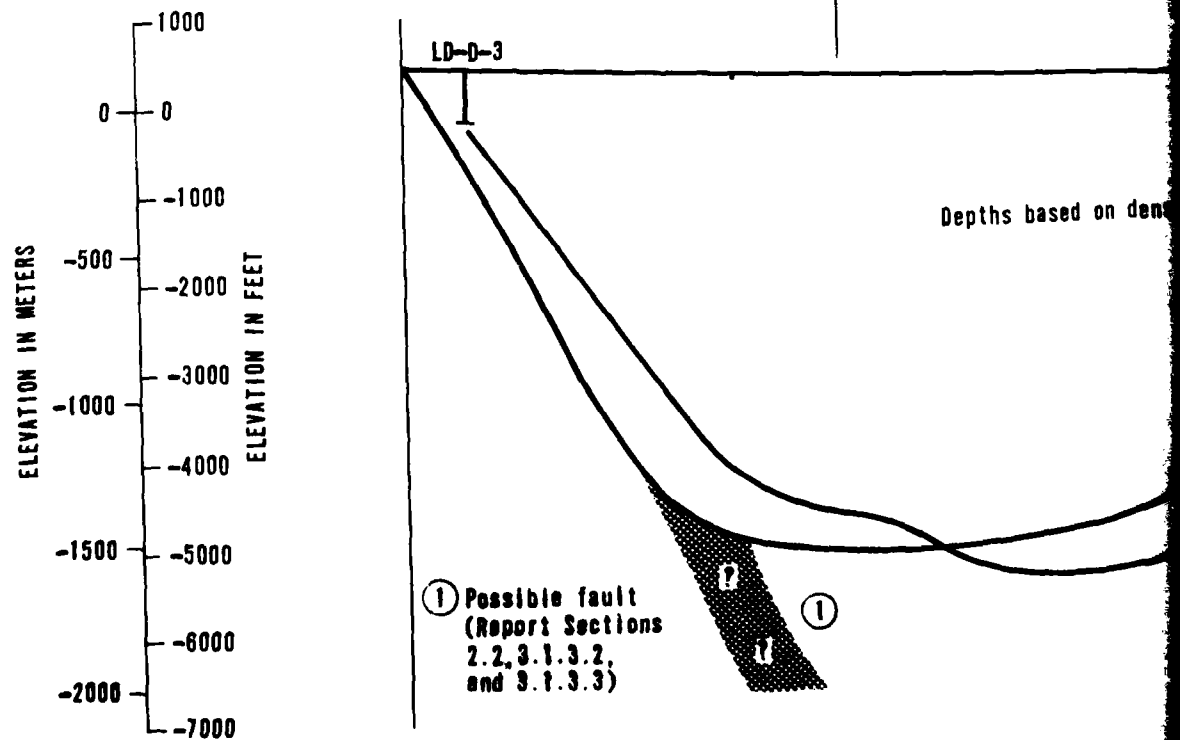
GRAVITY/MAGNETIC PROFILE

GRAVITY AND MAGNETIC



INTERPRETED BAS

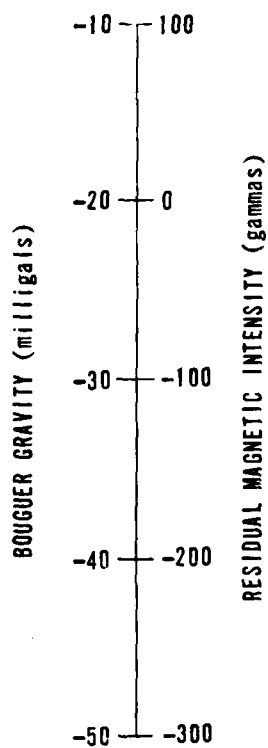
INTERSECT LD-DS-1 AND PROFILE BB'



PROFILE LD-G/MP-AA'

MAGNETIC PROFILES

A'
NE



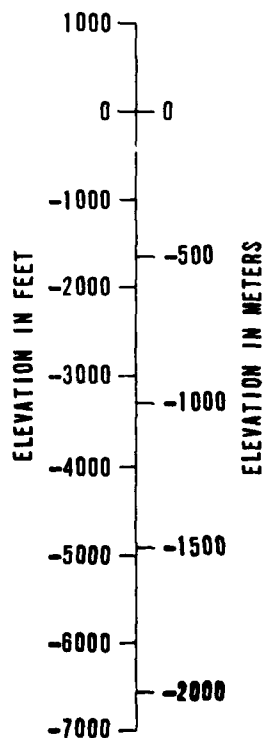
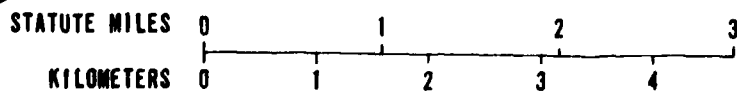
SEISMIC PROFILE

SURFACE

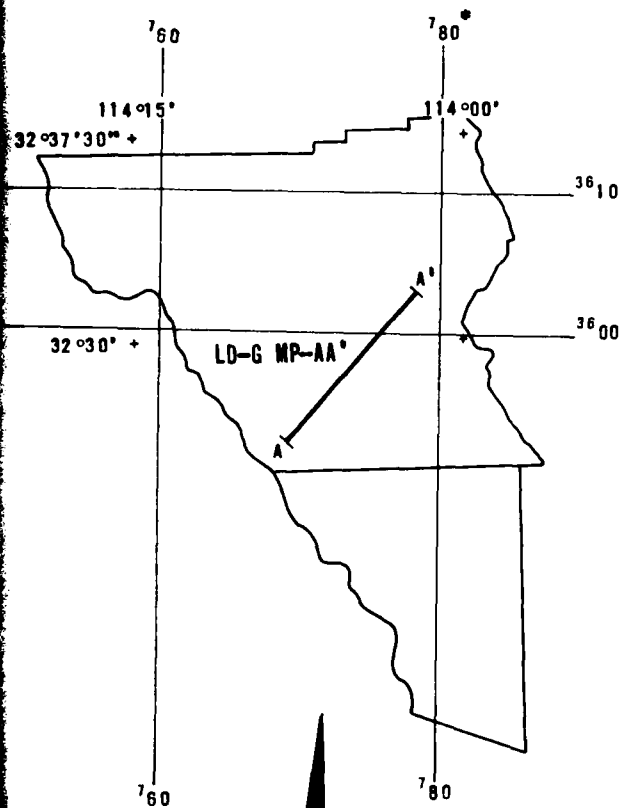
Density contrast of -0.26 gm cm^3

Basement profile based on seismic refraction interpretation

HORIZONTAL SCALE

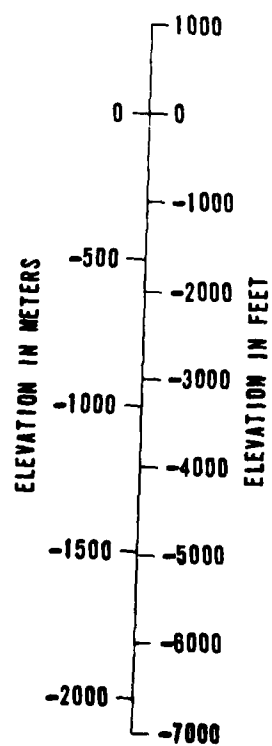
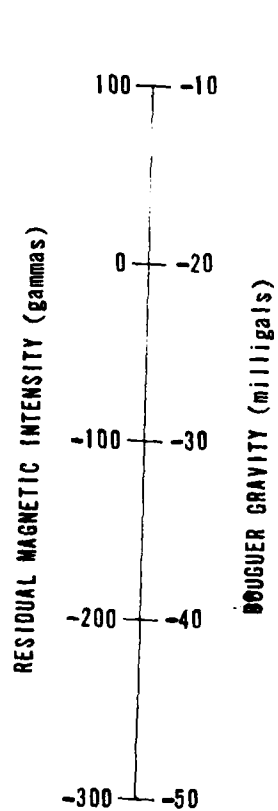


LOCATION MAP

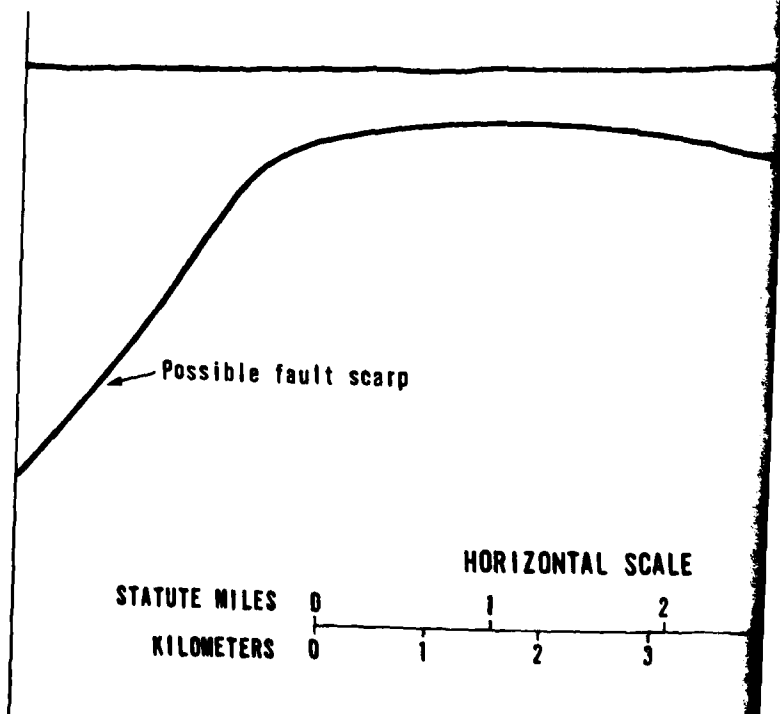
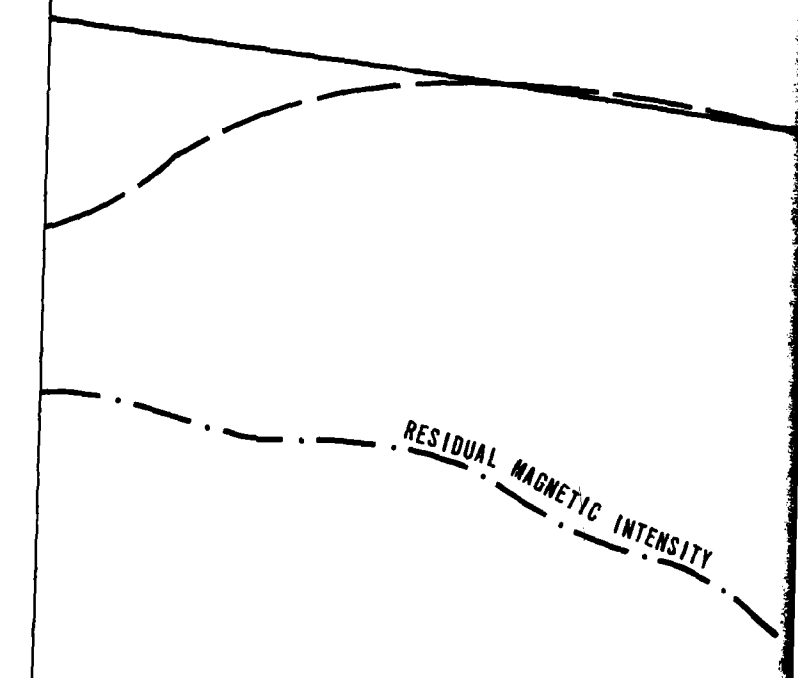


*NOTE: See Appendix page C-5 for explanation Universal Transverse Mercator Grid System.

TRANSVERSE MOUNTAIN - LD-G/MP-AA ENVIRONMENTAL AND GEOSCIENTIFIC DATA TRANSVERSE MOUNTAIN, ALASKA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANSO	FIGURE A-3
FUGRO NATIONAL INC.	



B
NW



Depths based on density contrast of -

GRAVITY/MAGNETIC PROFILE LD-G/MP-BB'

GRAVITY AND MAGNETIC PROFILES

REGIONAL GRAVITY

BOUGUER GRAVITY

INTERPRETED BASEMENT PROFILE

INTERSECT LD-DS

SURFACE

①

②

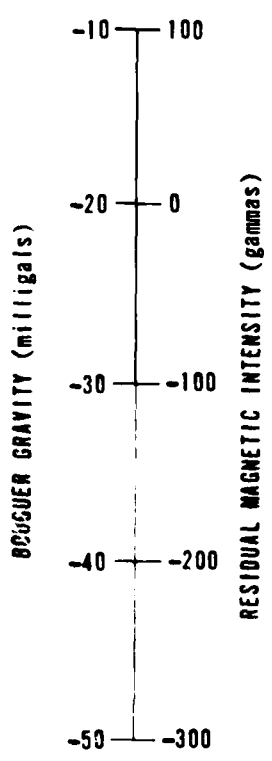
③

Basement profile based on seismic refraction interpretation

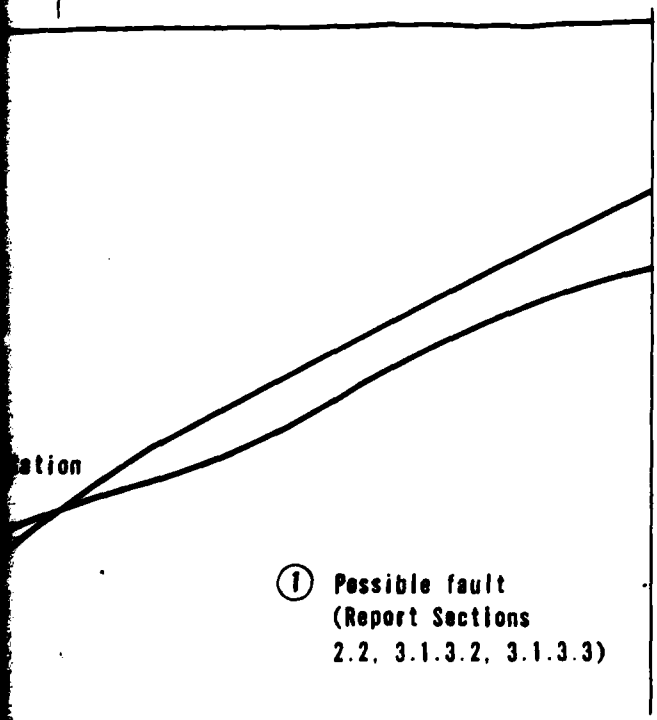
3

4

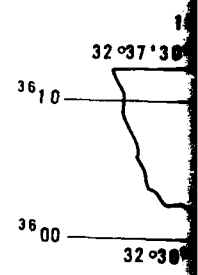
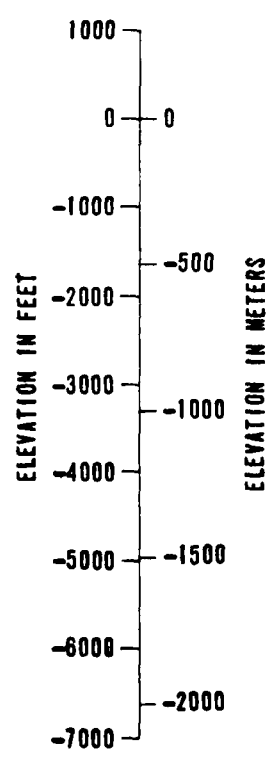
2.28 gm/cm³



BS-2 AND PROFILE AA'

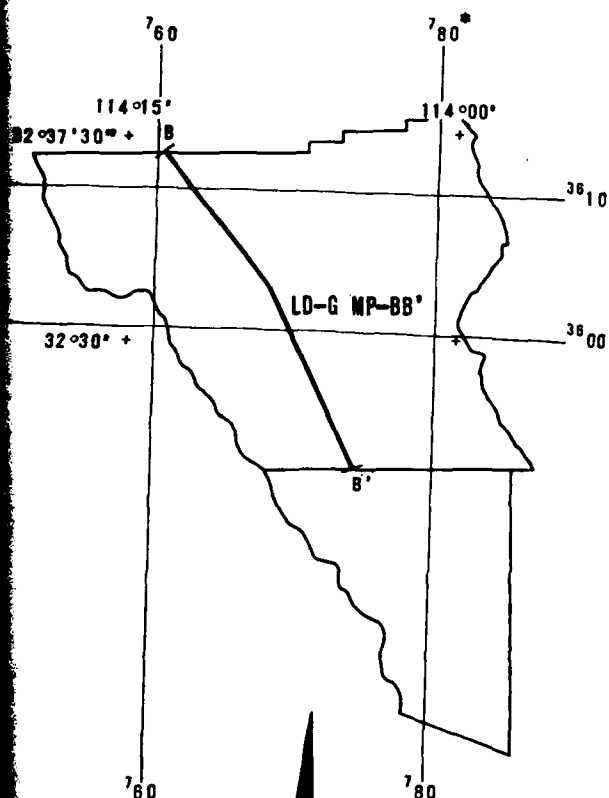


① Possible fault
(Report Sections
2.2, 3.1.3.2, 3.1.3.3)



*NOTE: 2

LOCATION MAP



1:500,000



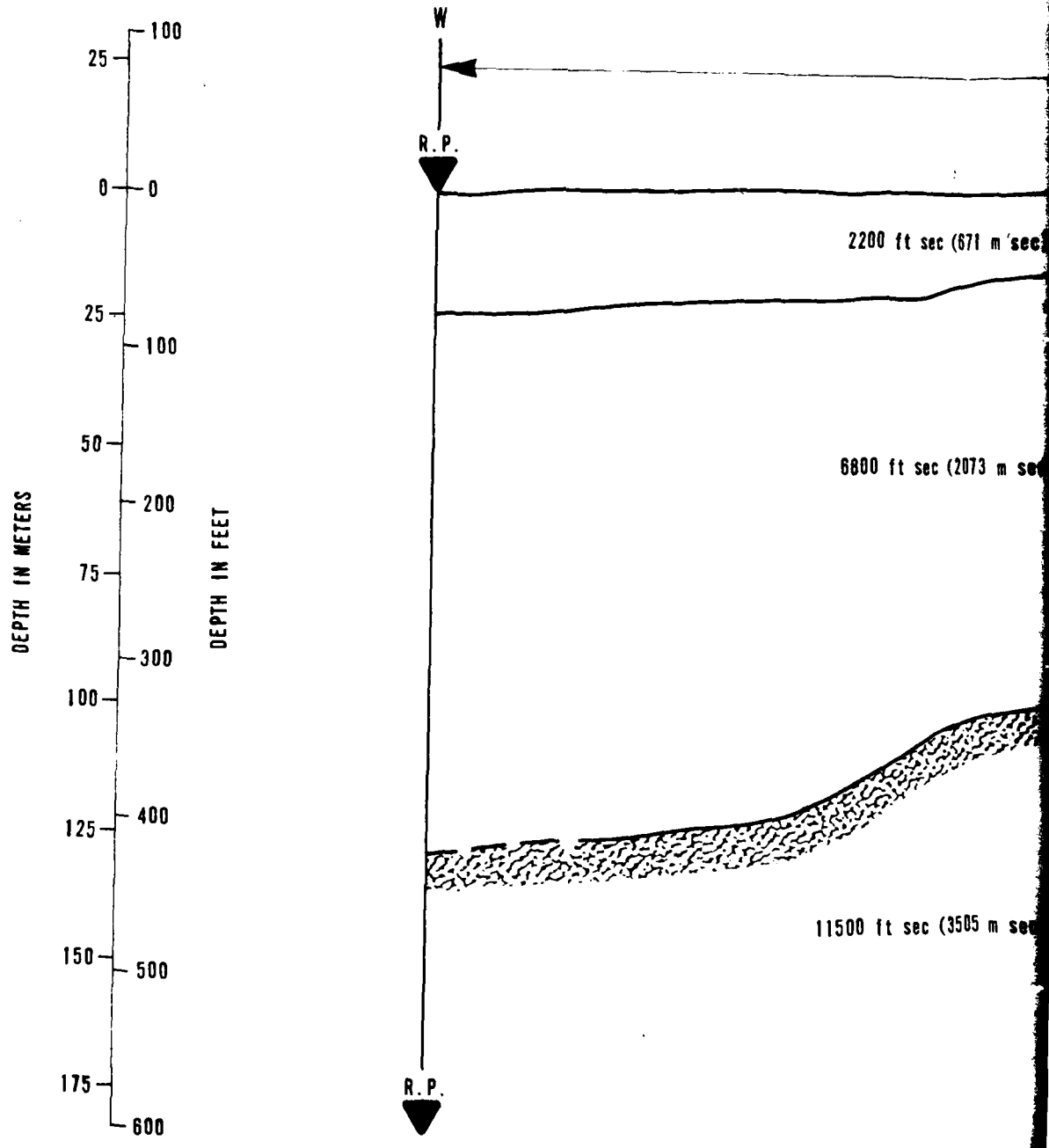
**LONGITUDINAL VALLEY PROFILE -
LD-G/MP-BB' GRAVITY AND MAGNETIC DATA
LECHUGUILLA DESERT, ARIZONA**

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SANSO

FIGURE
A-4

See Appendix page C-5 for explanation of Universal Transverse Mercator Grid System.

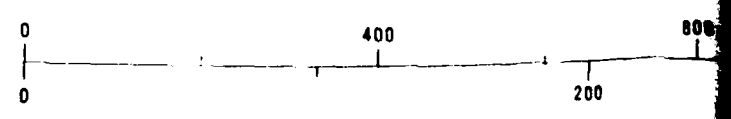
FUERO NATIONAL, INC.



DISTANCE IN FEET

DISTANCE IN METERS

SHOTPOINT LOCATIONS



VELOCITY SEISMIC REFRACT

DUE E

SPRE

GROUND SURFACE

BASEMENT

(sec)

(sec)

(sec)

000

1200

1600

2000

2400

400

600

G

H

Y PROFILE TION LINE LD-IS-1

READ A

2200 ft sec (671 m sec)

6800 ft sec (2073 m sec)

11500 ft sec (3505 m sec)

LD-B-4

SM
 SW/SM

SM

TD 100.3'
 (30.8m)

100'

NOTE: Dashed line represents a velocity
 horizon interpreted from questionable
 or insufficient data.

2800

3200

3600

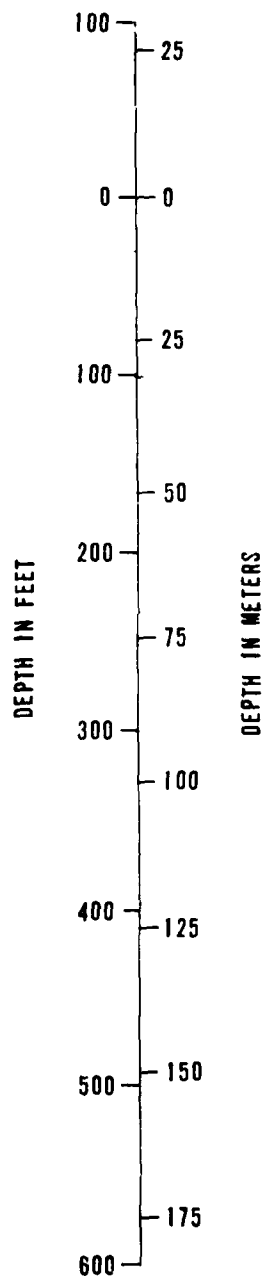
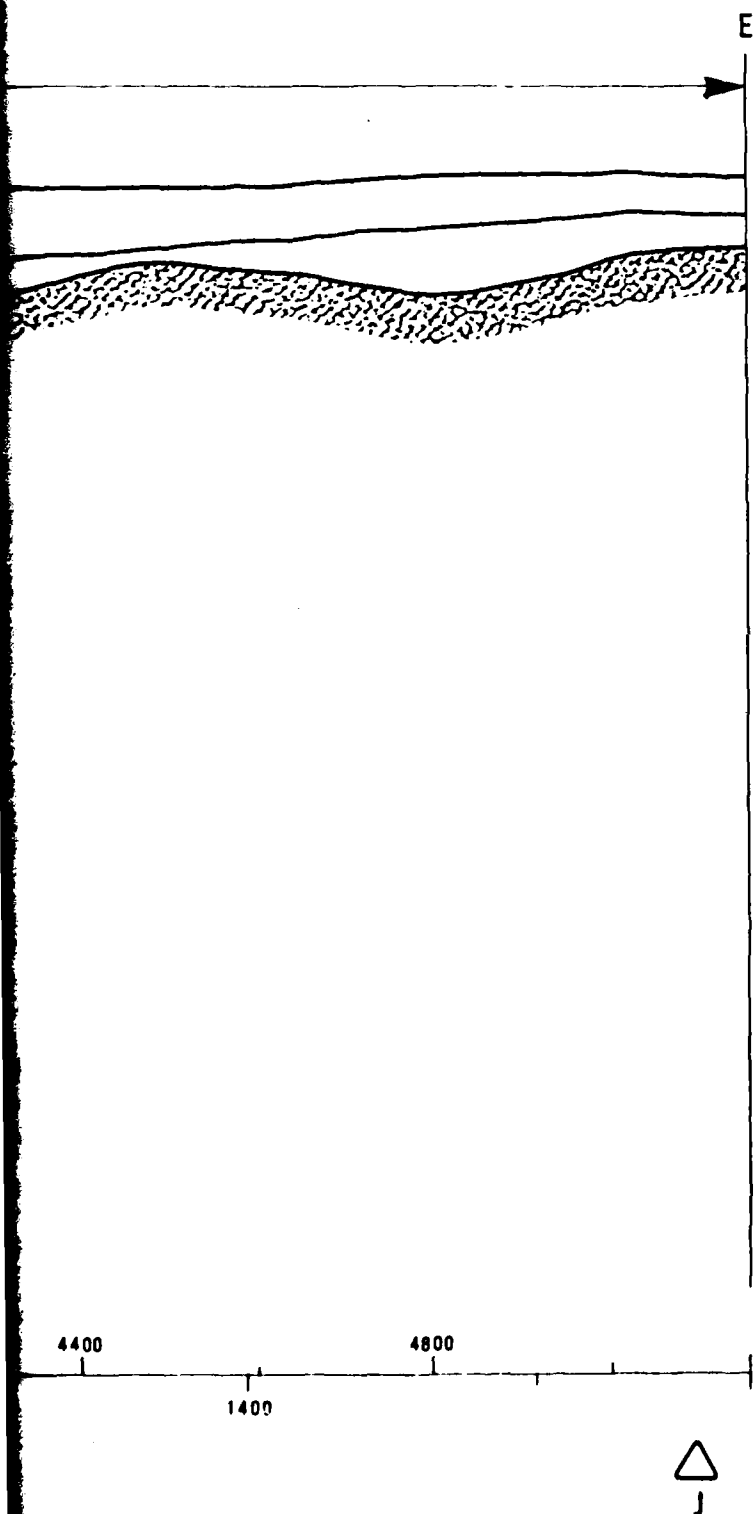
4000

800

1000

1200



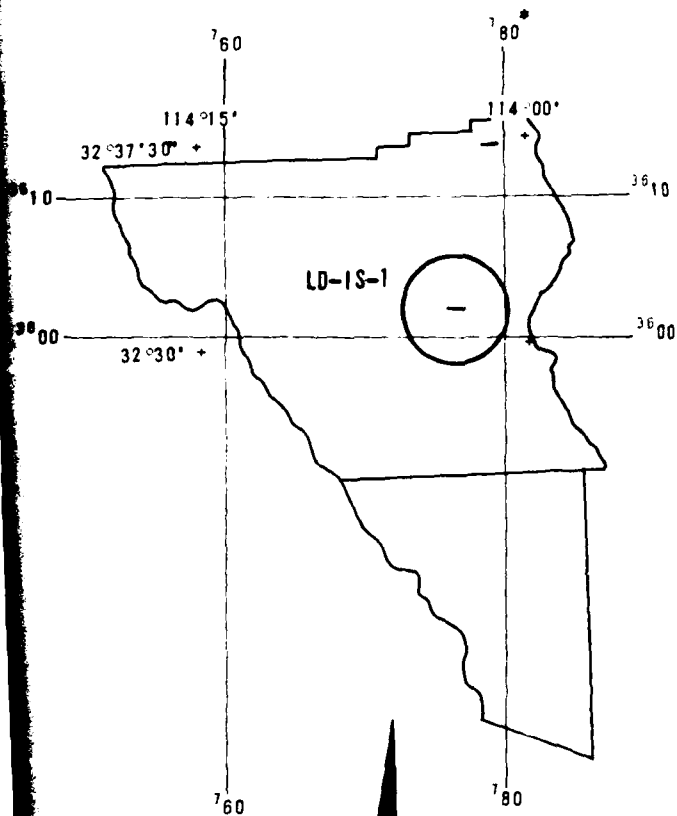


- Reference point on the ground surface used as the zero datum on the depth scale.

Vertical Exaggeration: 2X

H

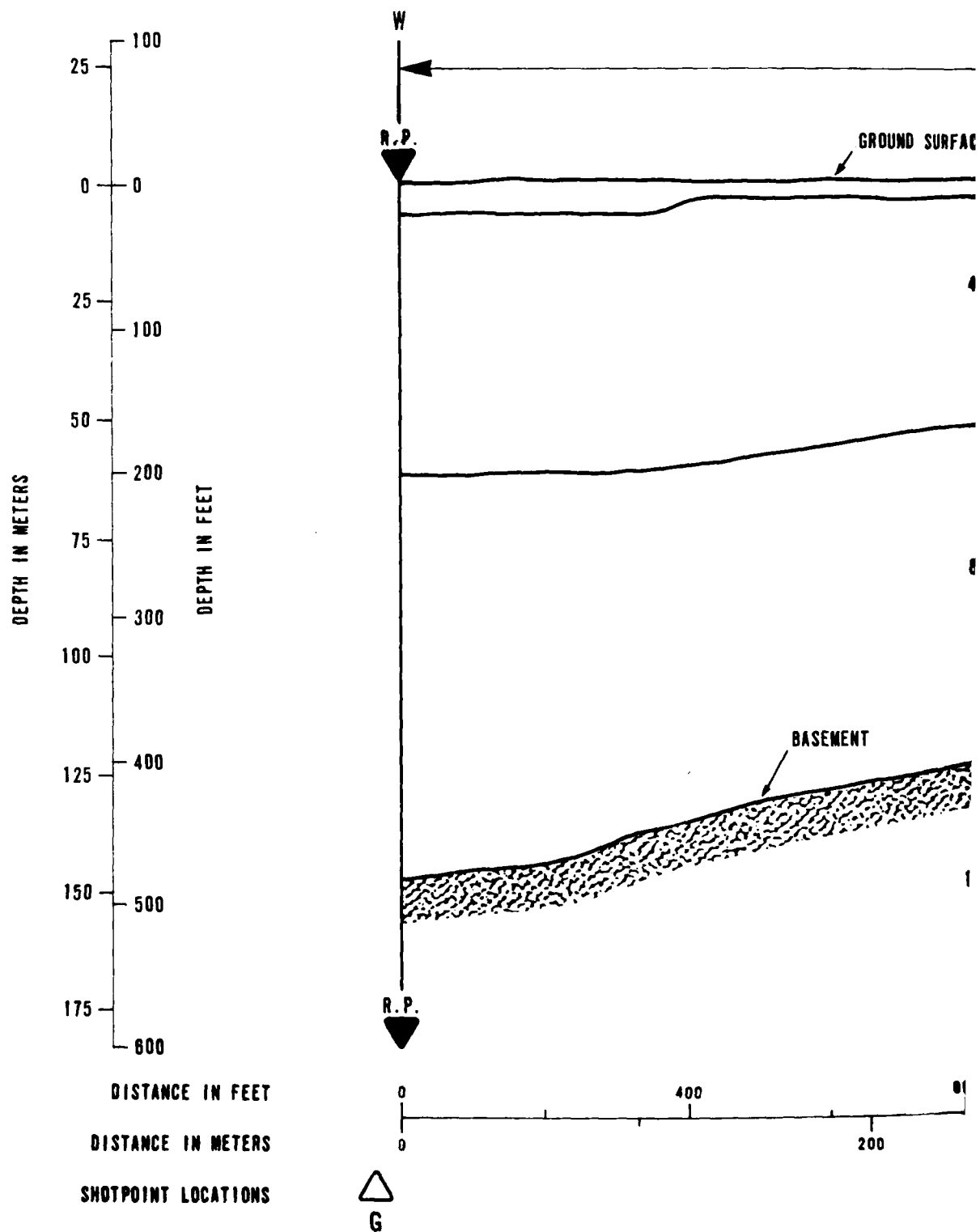
LOCATION MAP



VELOCITY PROFILE LD-1S-1 PERIMETER SEISMIC REFRACTION SURVEY LEGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE	SAMS FIGURE A-5
FUGRO NATIONAL, INC.	

*NOTE: See Appendix page C-5 for explanation Universal Transverse Mercator Grid System.

SEISMIC



VELOCITY PROFILE C REFRACTION LINE LD-IS-2

DUE E

SPREAD A

SURFACE

1250 ft sec (381 m/sec)

4000 ft sec (1219 m/sec)

8800 ft sec (2682 m/sec)

11500 ft sec (3505 m/sec)

DEPTH IN FEET

R.P.

- Reference surface used on the depth Vertical

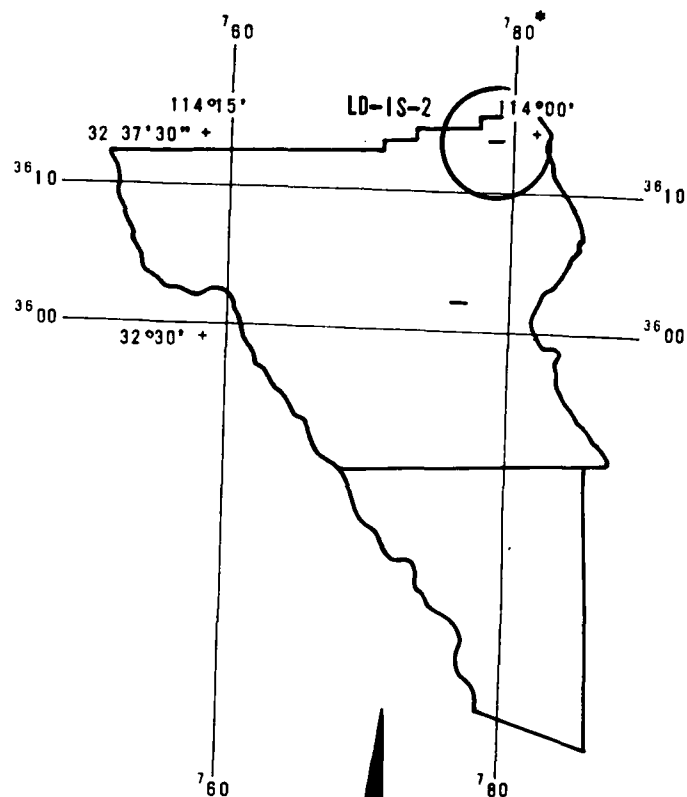
H

I

2

LOCATION MAP

DEPTH IN METERS



1:500,000



point on the ground
used as the zero datum
depth scale.

Exaggeration: 2X

*NOTE: See Appendix page C-5 for explanation of Universal Transverse Mercator Grid System.

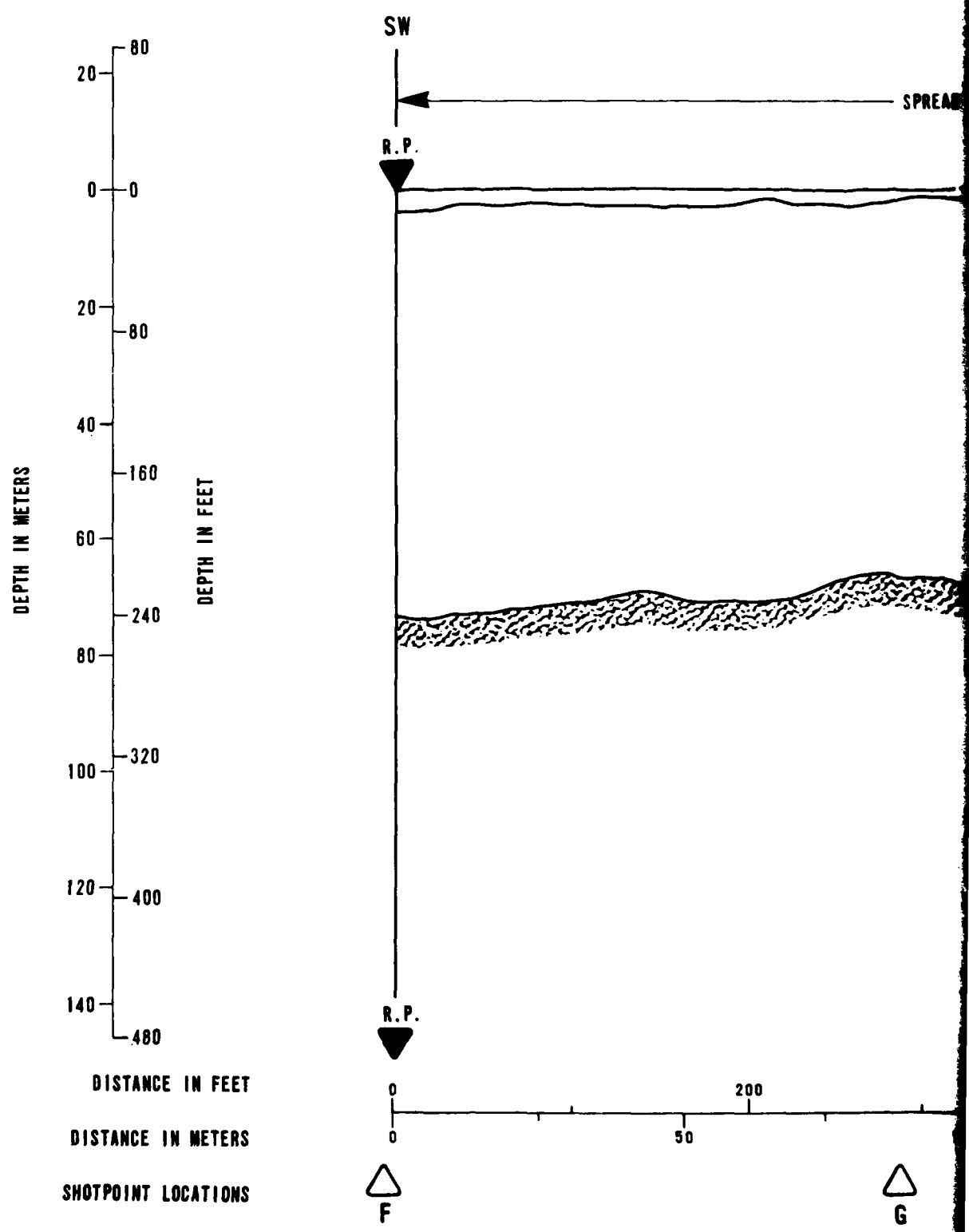
VELOCITY PROFILE 10-12-2
PERIMETER SURVEY REPRODUCTION SURVEY
LEGUENILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMSO

FIGURE
A-6

FUGRO NATIONAL INC.

CHECKED BY — APPROVED BY —



VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-1

N 45 E

SPREAD A

SPREAD B

GROUND SURFACE

1200 ft sec (366 m sec)

6300 ft sec (1920 m sec)

BASEMENT

100°

11500 ft sec (3505 m sec)

400

600

800

1000

100

150

200

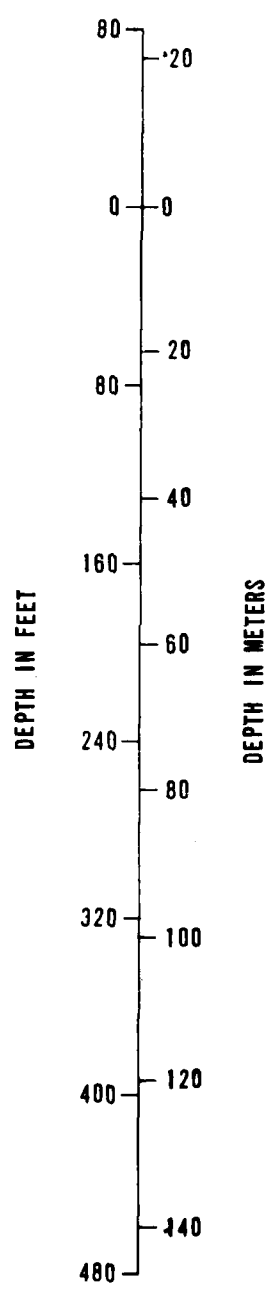
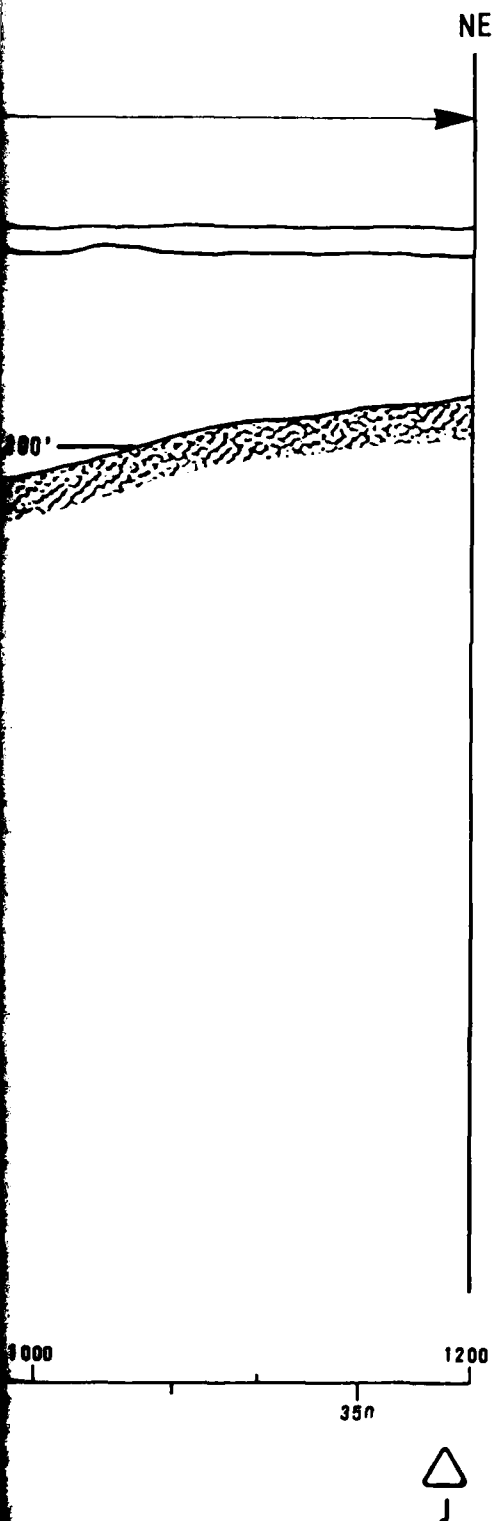
250


300



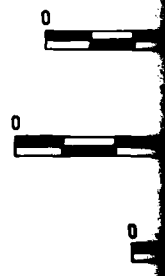
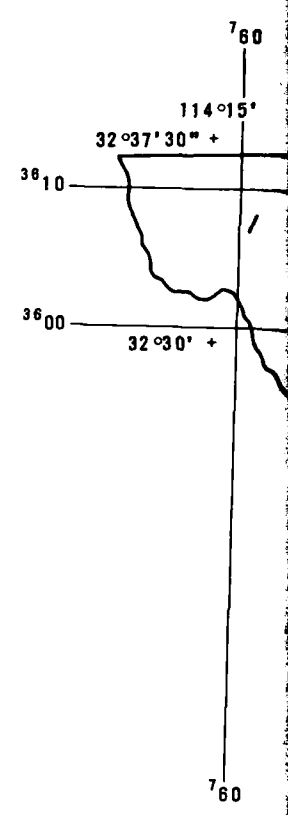
2

LO



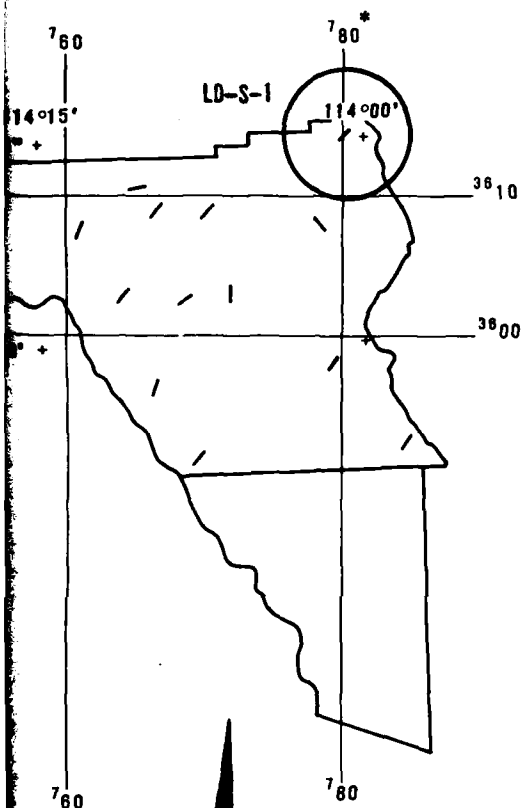
R.P.  - Reference point on the ground surface used as the zero datum on the depth scale.

No Vertical Exaggeration



*NOTE: See Appendix Transverse

LOCATION MAP



1:500,000

10 20
STATUTE MILES

10 20
NAUTICAL MILES

0 10 20
KILOMETERS

VELOCITY PROFILE LD-S-1
PERIMETER SEISMIC REFRACTION SURVEY
LECHUGUILLA DESERT, ARIZONA

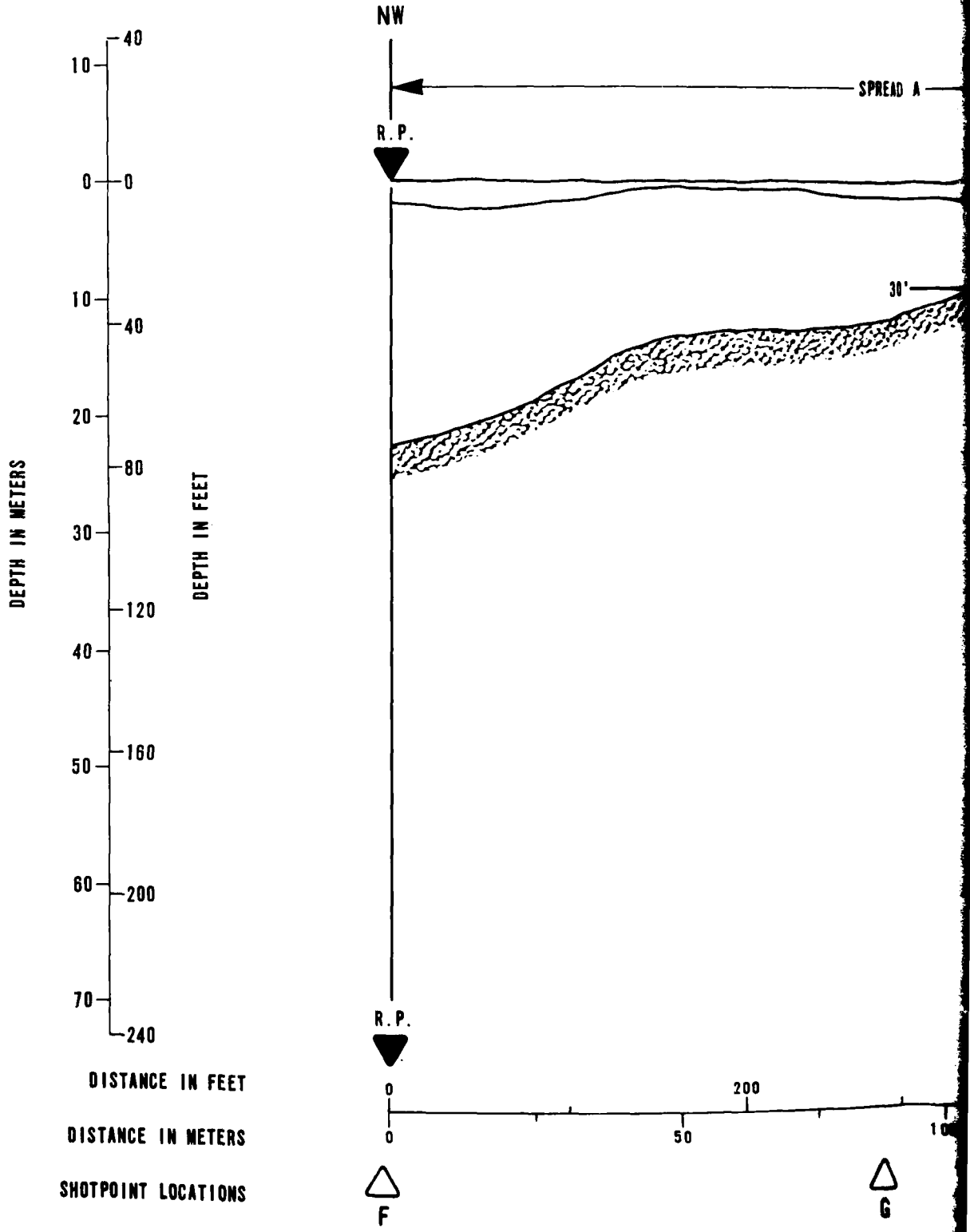
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
A-7

FUGRO NATIONAL, INC.

See Appendix page C-5 for explanation Universal
Transverse Mercator Grid System.

CHECKED BY _____ APPROVED BY _____



VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-2

S 70 E



A

SPREAD B

GROUND SURFACE

1200 ft sec (366 m sec)

5200 ft sec (1585 m sec)

BASEMENT

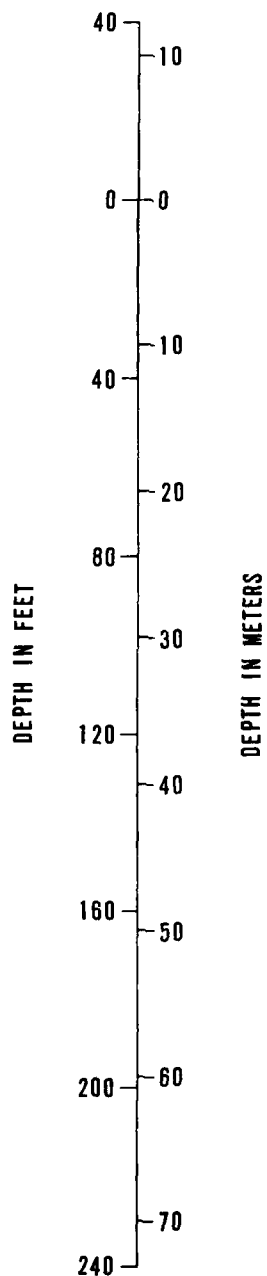
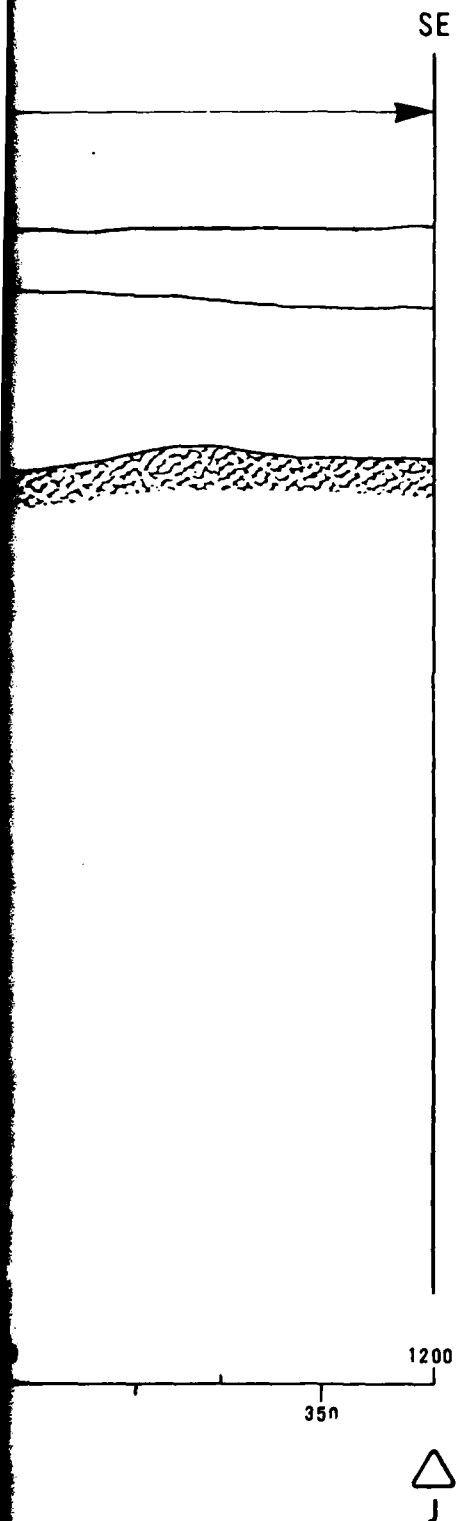
10600-11100 ft sec (3230-3383 m sec)

100 400 150 600 200 800 250 1000 300



2

LOCAT

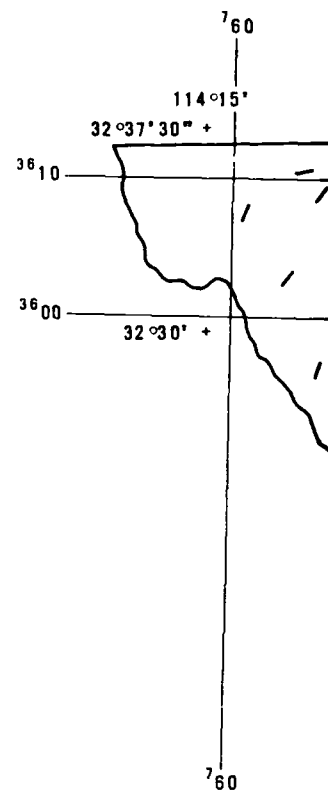


R.P.



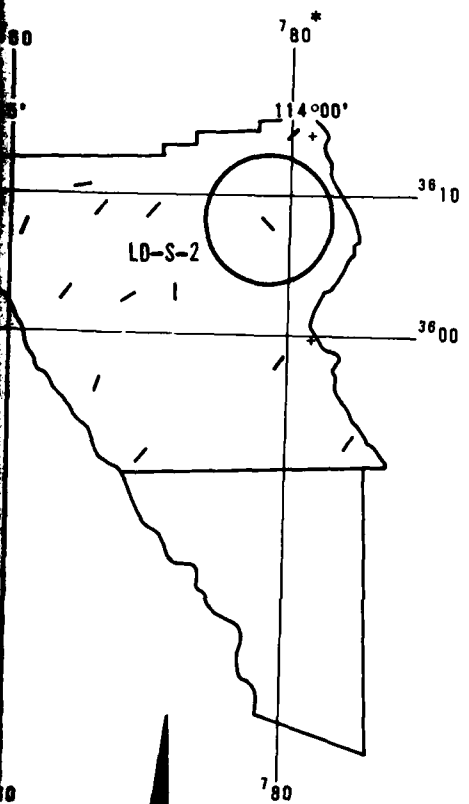
- Reference point on the ground surface used as the zero datum on the depth scale.

Vertical Exaggeration: 2X



*NOTE: See Appendix of Transverse Map

LOCATION MAP



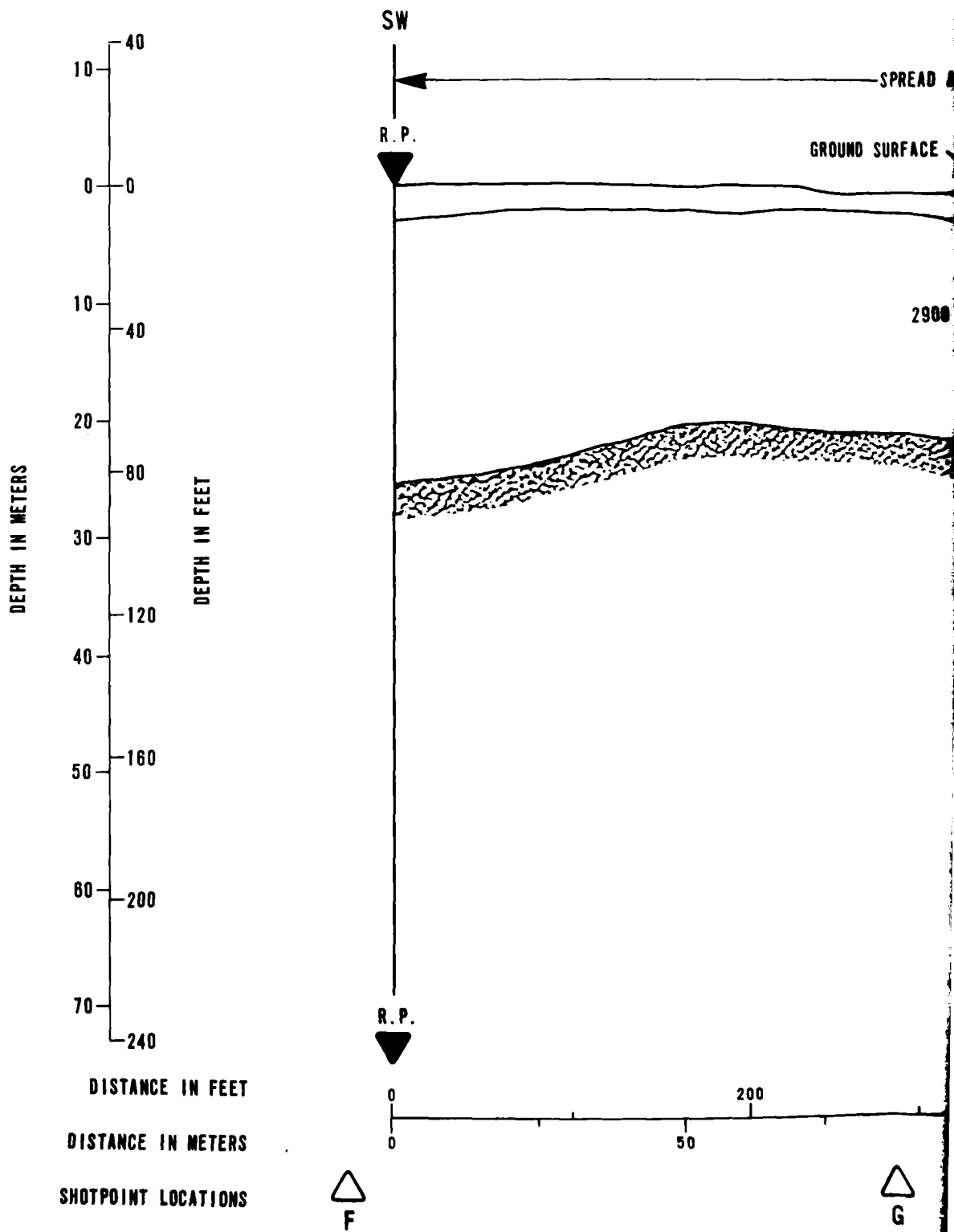
1:500,000



See page C-5 for explanation of Universal
Mercator Grid System.

VELOCITY PROFILE LD-S-2 PERIMETER SEISMIC REFRACTION SURVEY LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMS0	FIGURE A-8
FUGRO NATIONAL, INC.	

CHE BY ... PROVLC



VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-4

N 60 E

SPREAD A

SPREAD B

SURFACE

1500 ft sec (457 m sec)

2900 ft sec (884 m sec)

BASEMENT

30'

7500 m sec (2286 m sec)

400

600

800

11

100

150

200

250

300

G

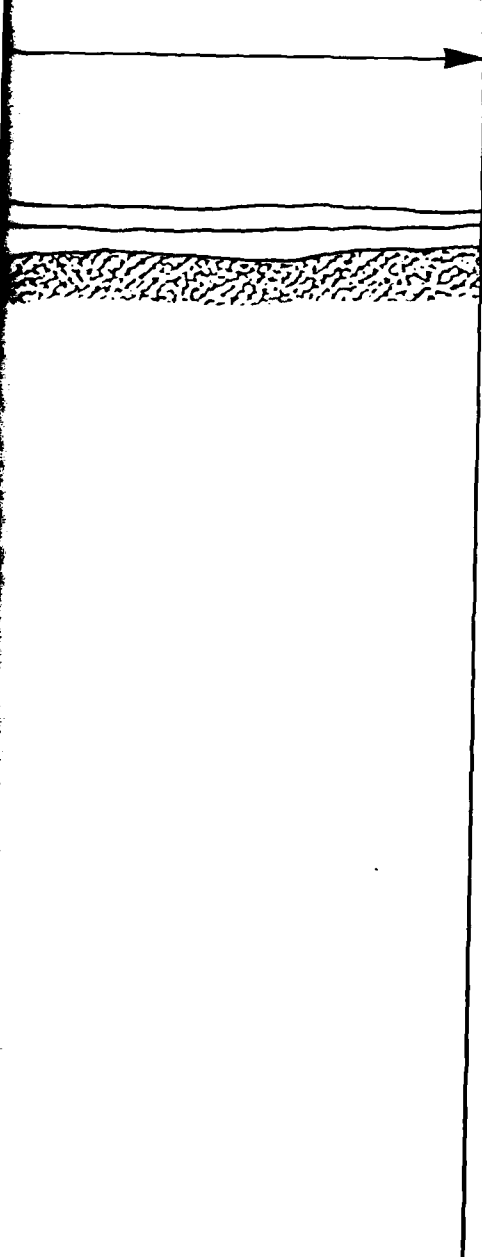
H

I

2

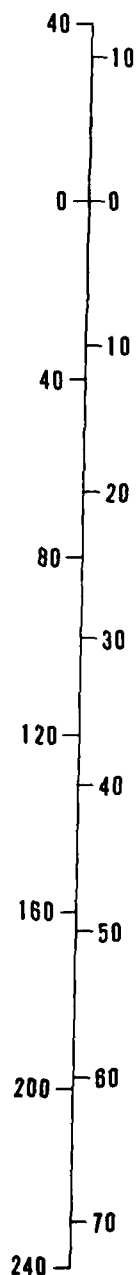
LO

NE



DEPTH IN FEET

DEPTH IN METERS

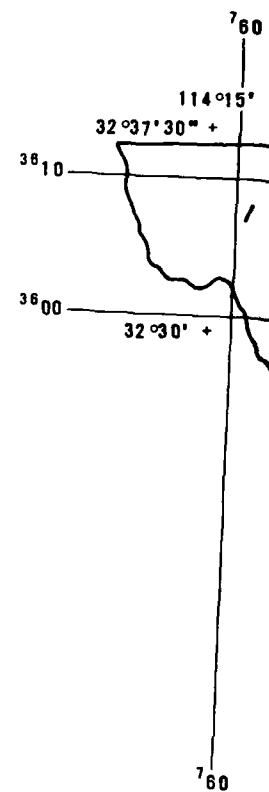


R.P.



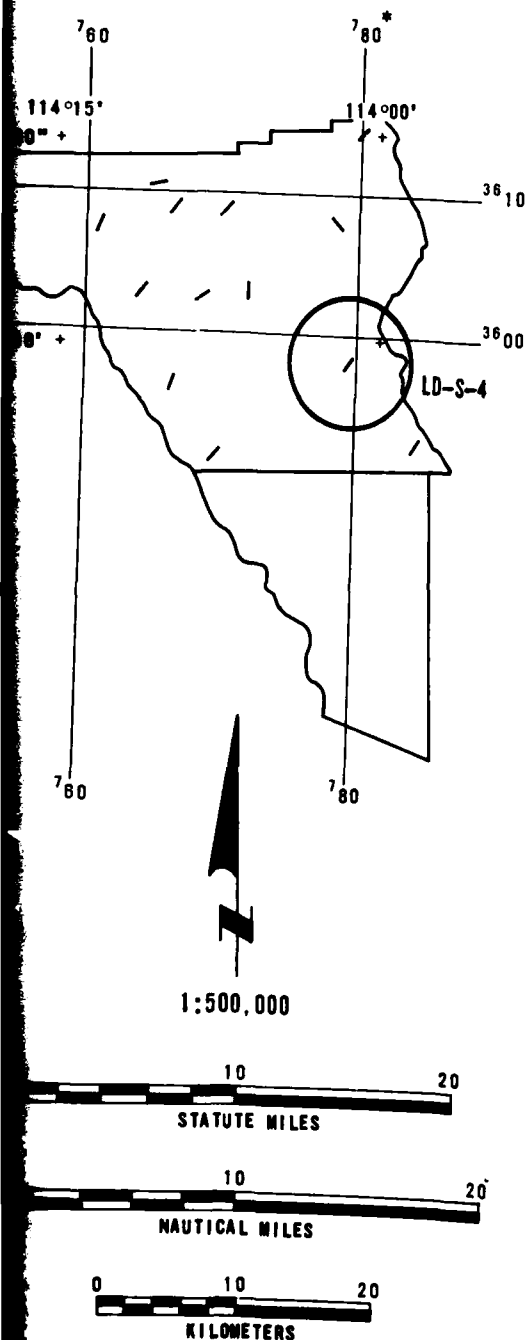
- Reference point on the ground surface used as the zero datum on the depth scale.

Vertical Exaggeration: 2X



*NOTE: See Appendix Transverse

LOCATION MAP



VELOCITY PROFILE LD-S-4
PERIMETER SEISMIC REFRACTION SURVEY
LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMS0

FIGURE
A-9

FUGRO NATIONAL, INC.

Appendix page C-5 for explanation of Universal
Transverse Mercator Grid System.

PROVI

BY

CHE

DEPTH IN METERS

DEPTH IN FEET

40
10
0
10
20
30
40
50
60
70
240

DISTANCE IN FEET
DISTANCE IN METERS
SHOTPOINT LOCATIONS

F

SW

SPREAD A

200

50

100

G

VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-5

N 61 E

A

SPREAD B

GROUND SURFACE

1300 ft sec (396 m sec)

BASEMENT

30'

3000 ft sec (914 m sec)

9900 ft sec (3018 m sec)

400

800

800

1000

150

200

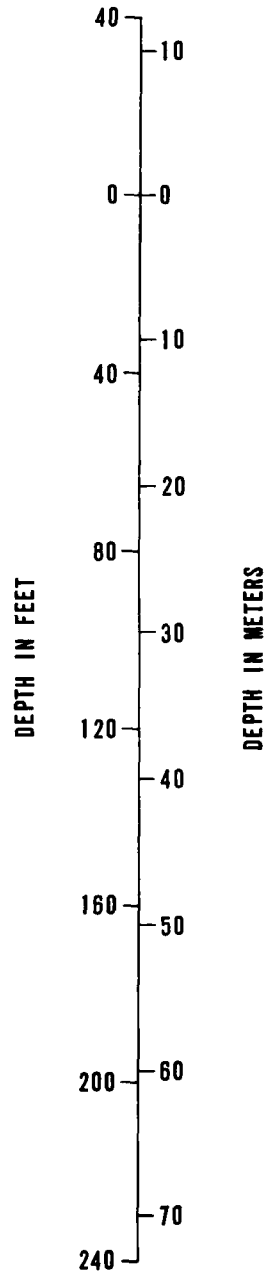
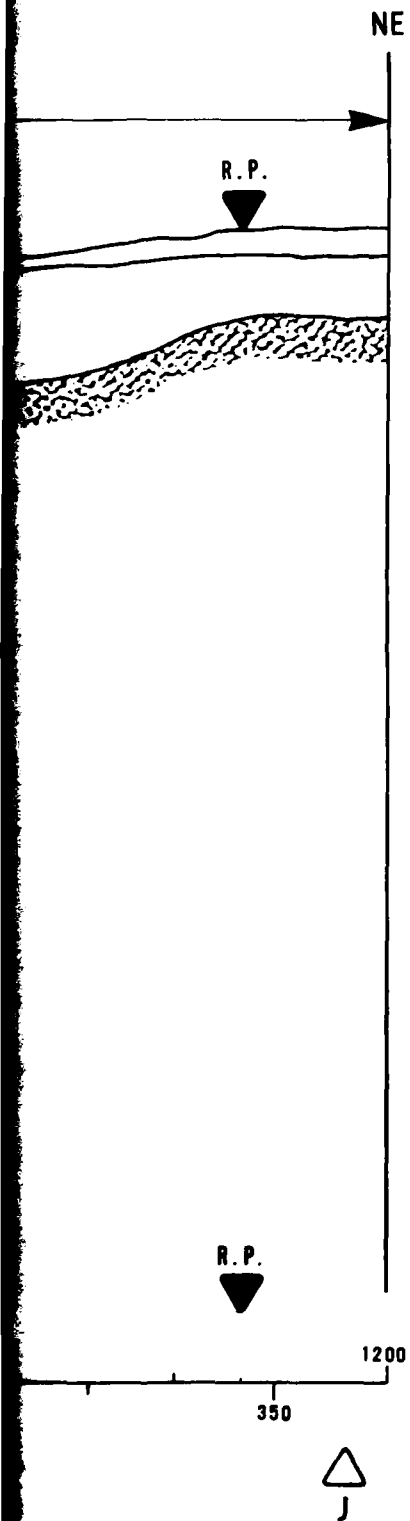
250

300



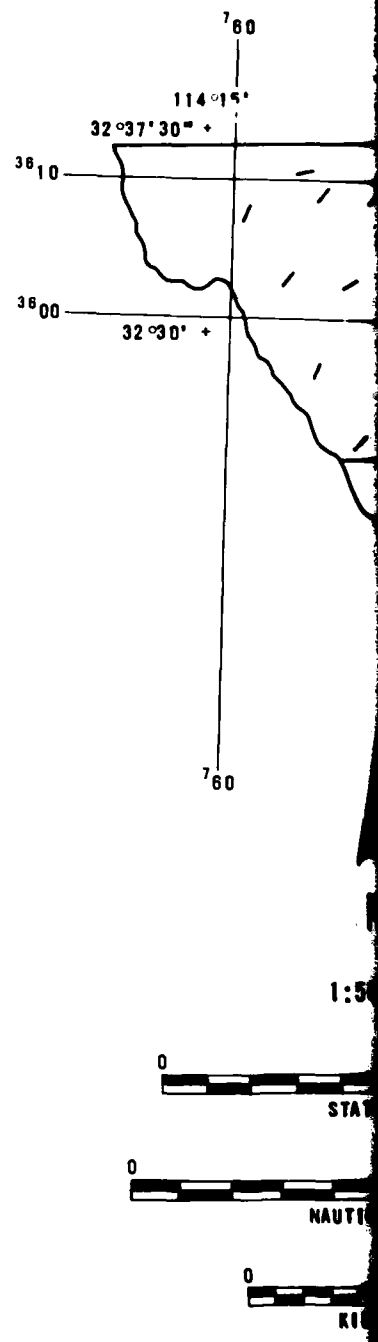
2

LOCATION



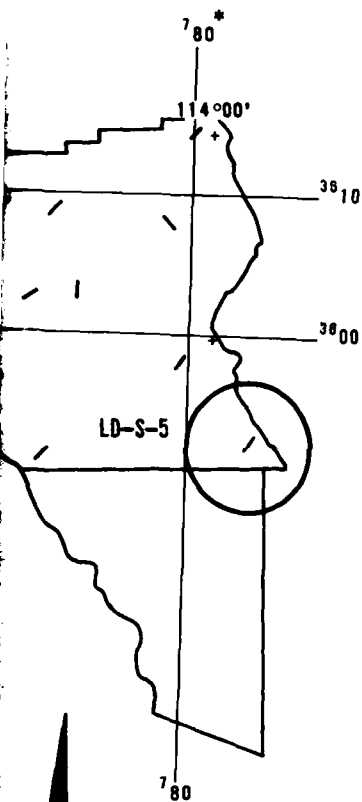
R.P. - Reference point on the ground surface used as the zero datum on the depth scale.

Vertical Exaggeration: 2X



*NOTE: See Appendix page Transverse Mercator

TION MAP



1:500,000

10 20

STATUTE MILES

10 20

NAUTICAL MILES

10 20

KILOMETERS

VELOCITY PROFILE LD-S-5
PERIMETER SEISMIC REFRACTION SURVEY
LECHUGUILLA DESERT, ARIZONA

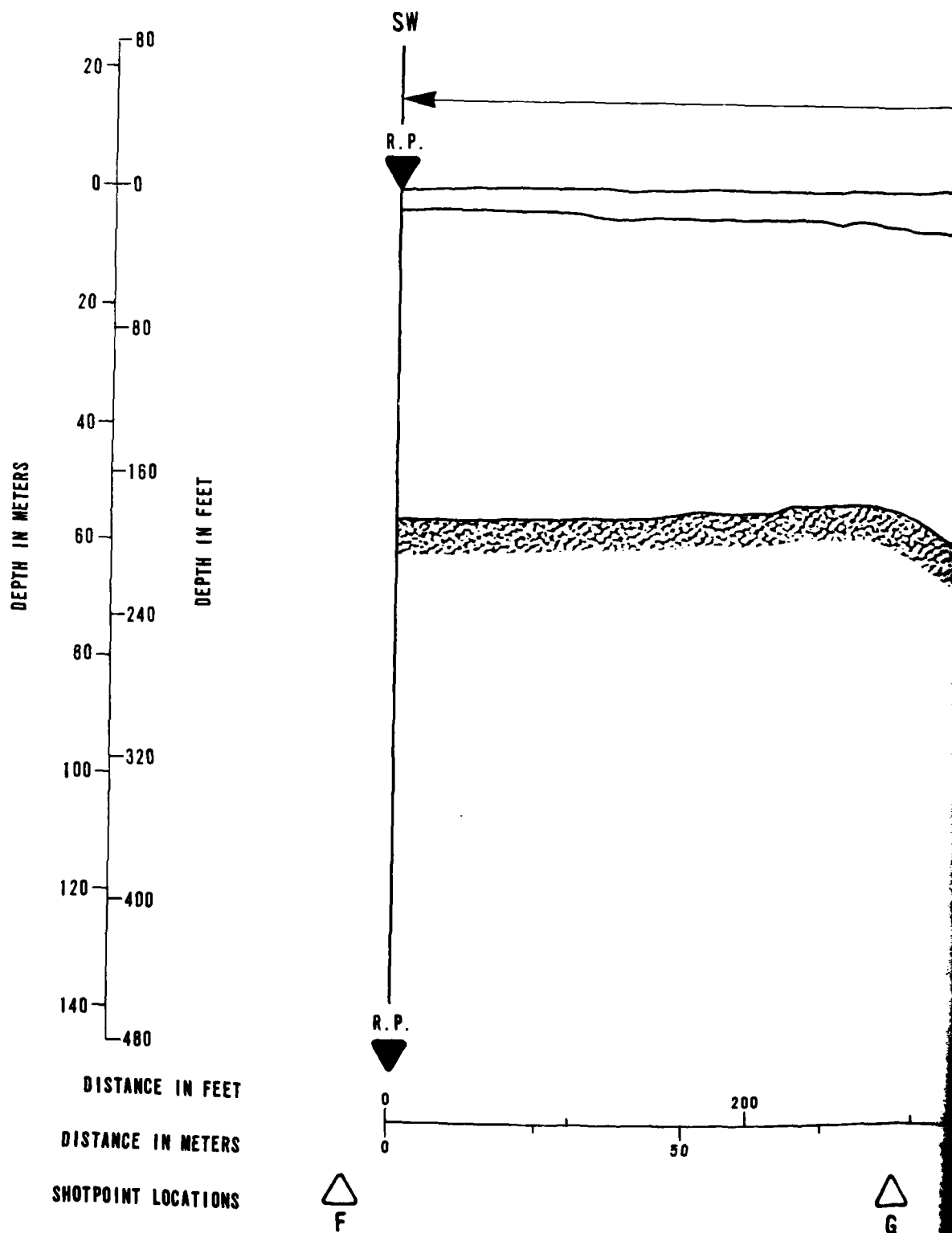
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
A-10

FUGRO NATIONAL, INC.

Page C-5 for explanation Universal
Meter Grid System.

CHECKED BY ——— APPROVED BY ———



VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-6

N 65 E

SPREAD A

GROUND SURFACE

1850 ft sec (564 m sec)

6400 ft sec (1951 m sec)

BASEMENT

14500 ft sec (4420 m sec)

400

600

800

1000

100

150

200

250

300



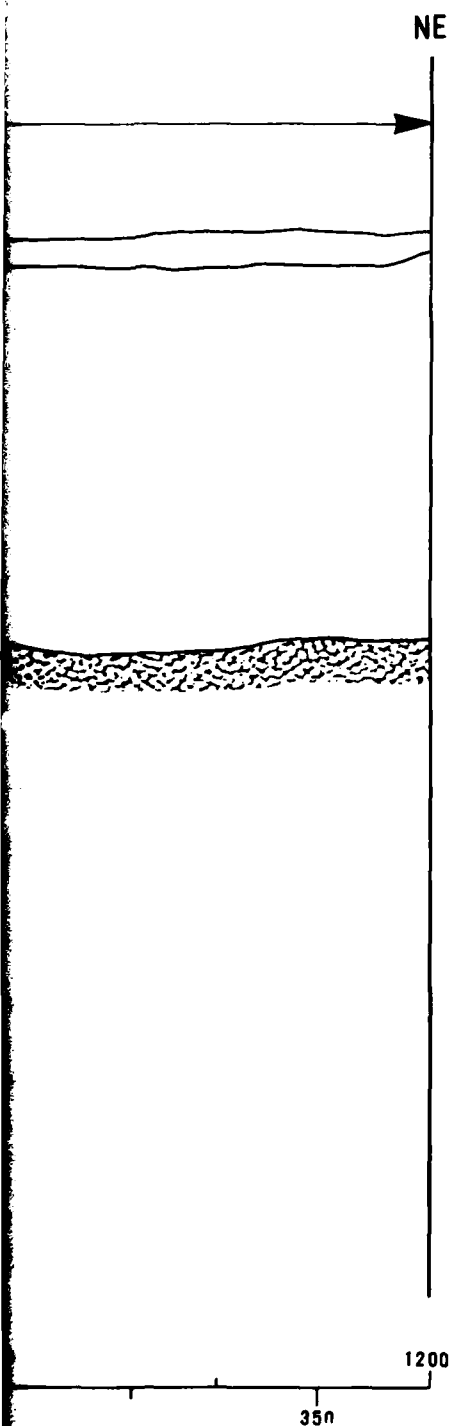
H



I

2

LOCAL

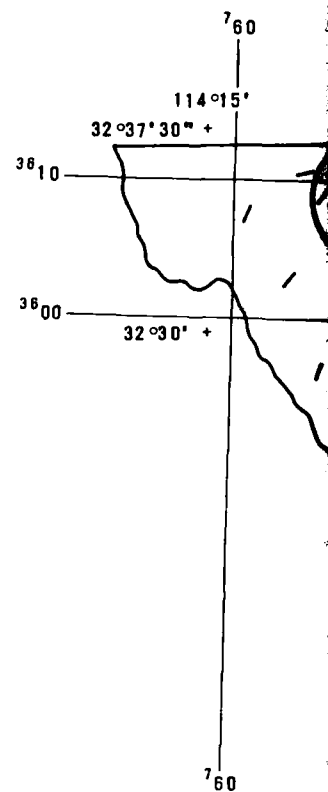


R.P.



- Reference point on the ground surface used as the zero datum on the depth scale.

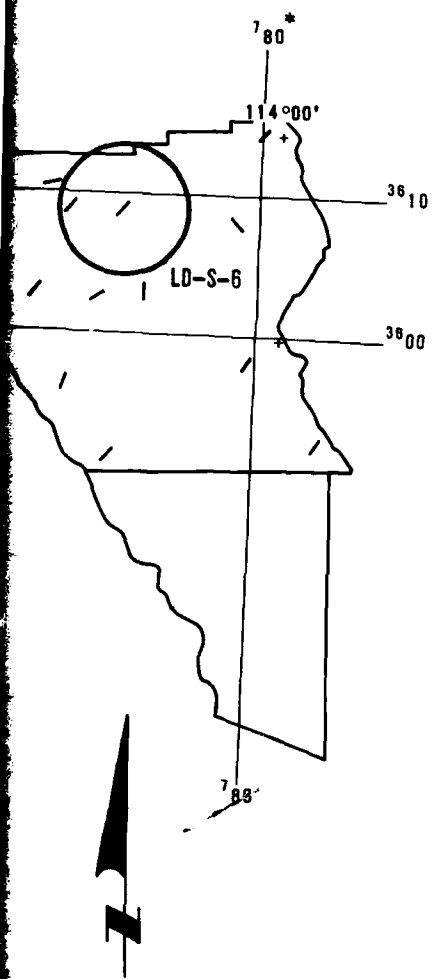
No Vertical Exaggeration



0

*NOTE: See Appendix Transverse

LOCATION MAP



1:500,000

10 20
STATUTE MILES

10 20
NAUTICAL MILES

10 20
KILOMETERS

VELOCITY PROFILE LD-S-6
PERIMETER SEISMIC REFRACTION SURVEY
LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
A-11

FUGRO NATIONAL, INC.

PROV

BY

CHE

DEPTH IN METERS

DEPTH IN FEET

DISTANCE IN FEET
DISTANCE IN METERS
SHOTPOINT LOCATIONS

SW

0

200

0

50

F

G

VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-7

N 57 E

SPREAD A

R.P.

GROUND SURFACE

1350 ft sec (411 m sec)

3250 ft sec (991 m sec)

100'

BASEMENT

11300 ft sec (3444 m sec)

R.P.

400

800

800

1000

100

150

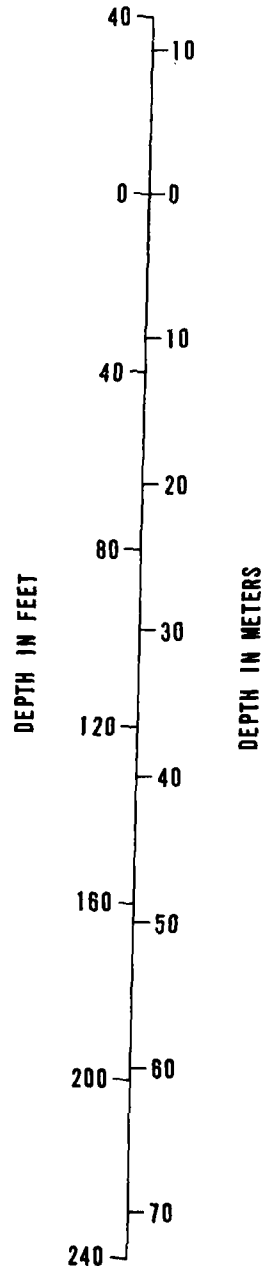
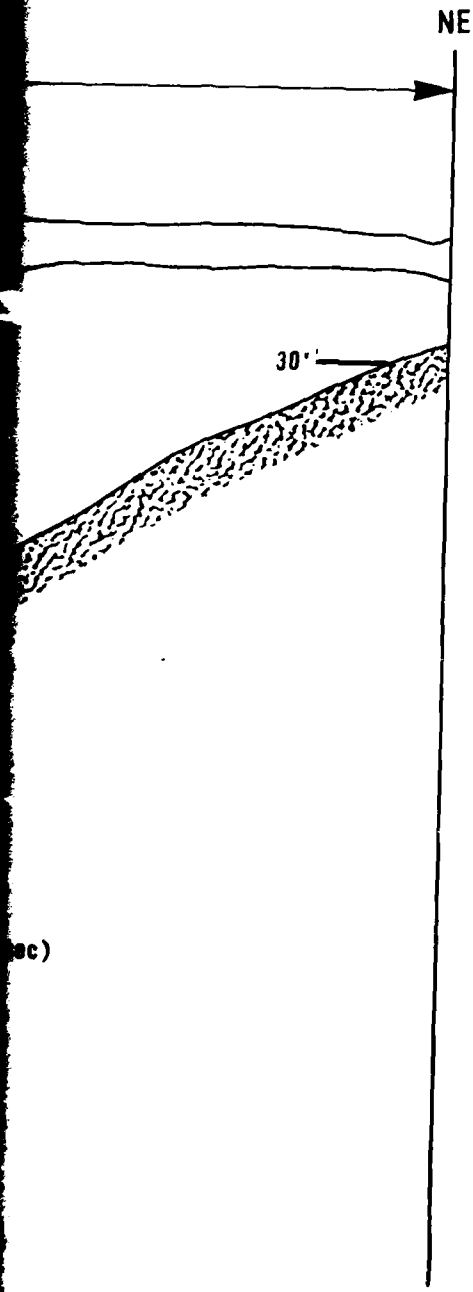
200


250

300

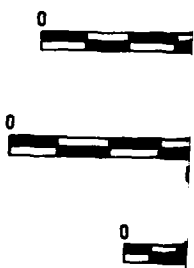
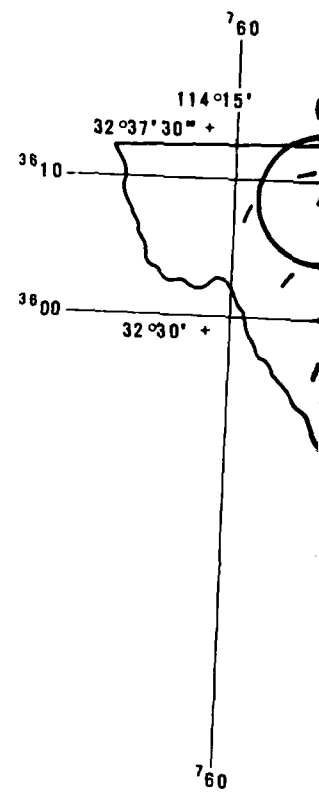


LOCA



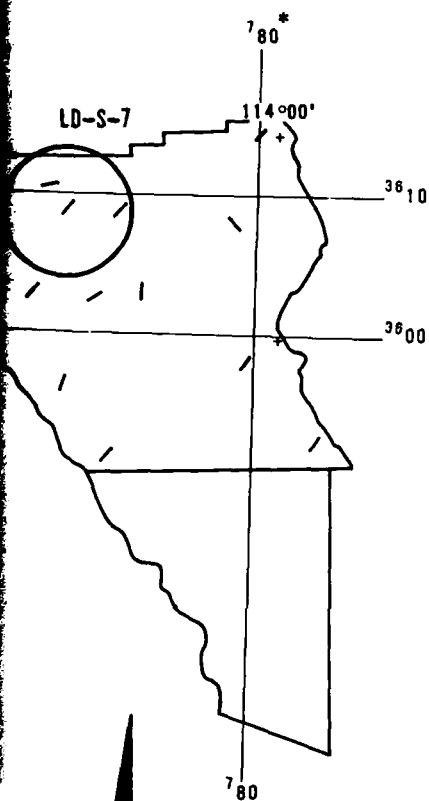
R.P.  - Reference point on the ground surface used as the zero datum on the depth scale.

Vertical Exaggeration: 2X



*NOTE: See Appendix Transverse

LOCATION MAP



1:500,000

10 20
STATUTE MILES

10 20
NAUTICAL MILES

10 20
KILOMETERS

See page C-5 for explanation of Universal
Mercator Grid System.

VELOCITY PROFILE LD-S-7
PERIMETER SEISMIC REFRACTION SURVEY
LECHUGUILLA DESERT, ARIZONA

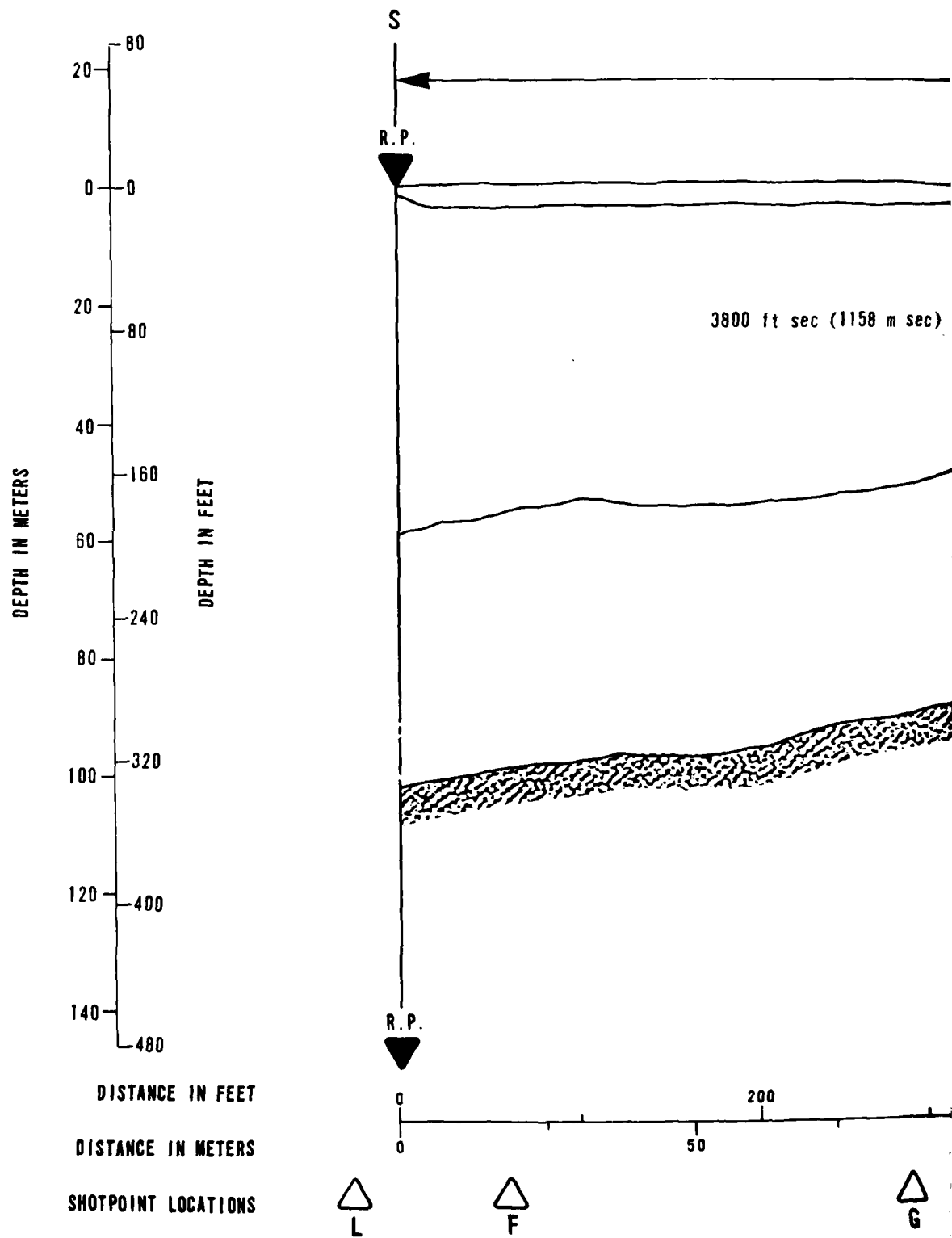
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
A-12

FUGRO NATIONAL, INC.

4

CHECKED BY _____ APPROVED BY _____



VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-8

DUE N

SPREAD A

GROUND SURFACE

1900 ft sec (579 m sec)

5900 ft sec (1798 m sec)

BASEMENT

11200 ft sec (3414 m sec)

400

600

800

1000

100

150

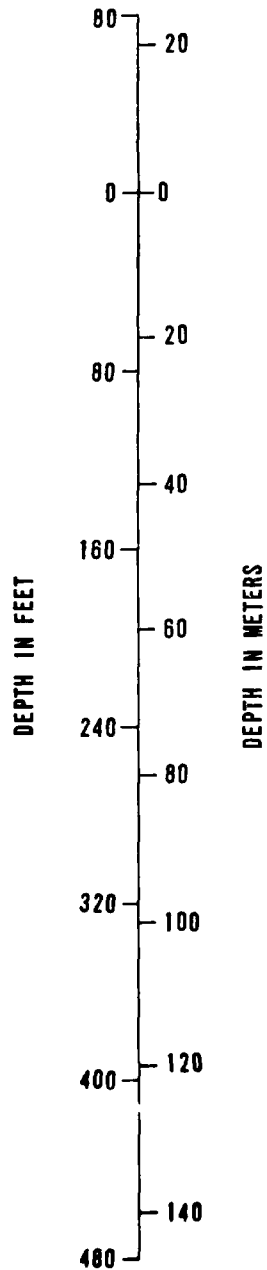
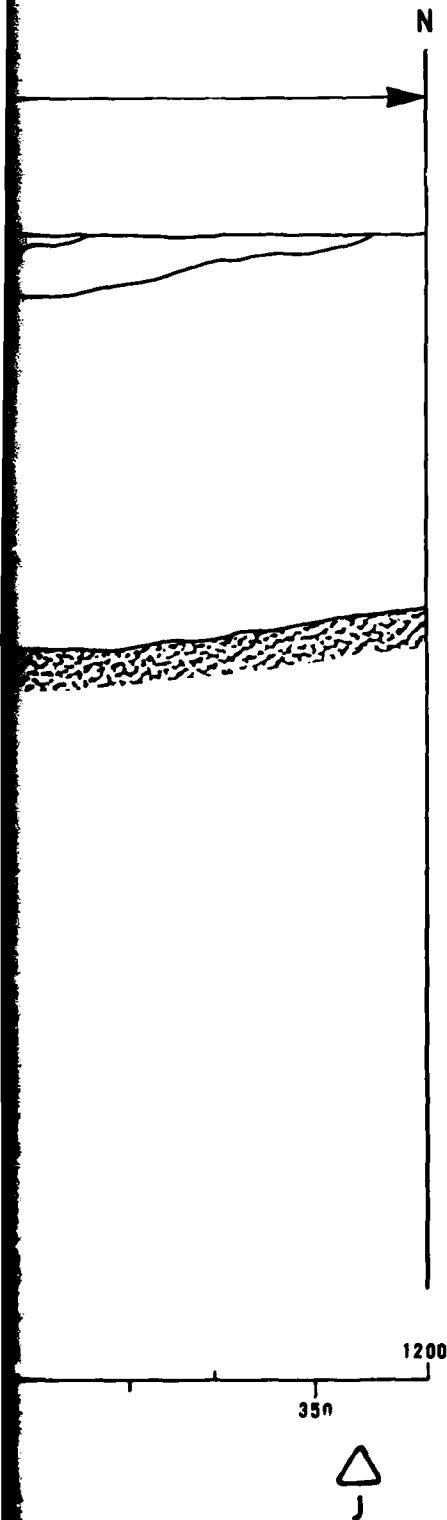
200

250

300

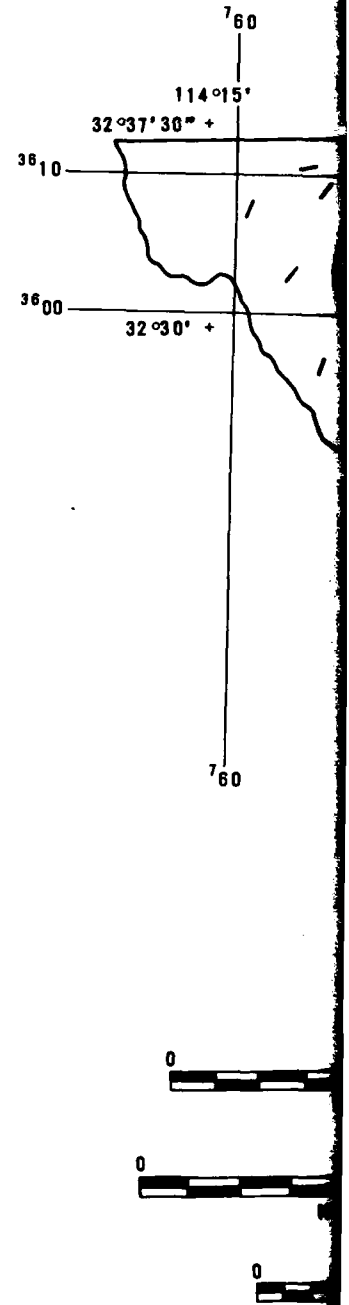


LOCAT



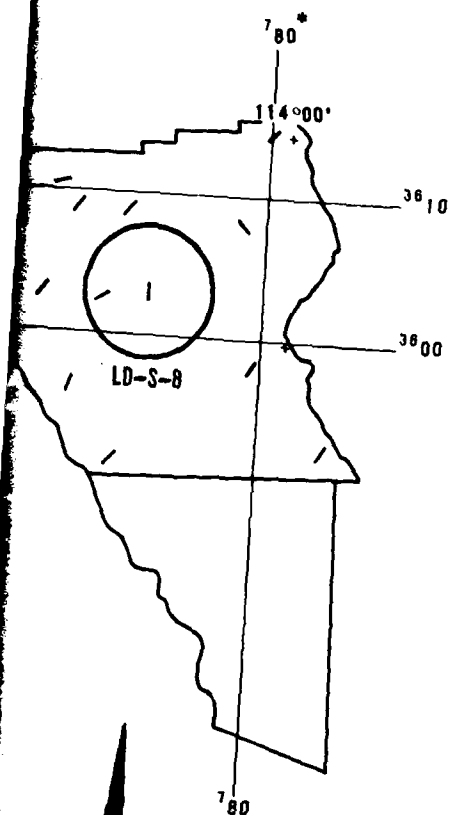
R.P. - Reference point on the ground surface used as the zero datum on the depth scale.

No Vertical Exaggeration



NOTE: See Appendix Transverse

LOCATION MAP



1:500,000

10 20
STATUTE MILES

10 20
NAUTICAL MILES

10 20
KILOMETERS

VELOCITY PROFILE LD-S-8
PERIMETER SEISMIC REFRACTION SURVEY
LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SANSO

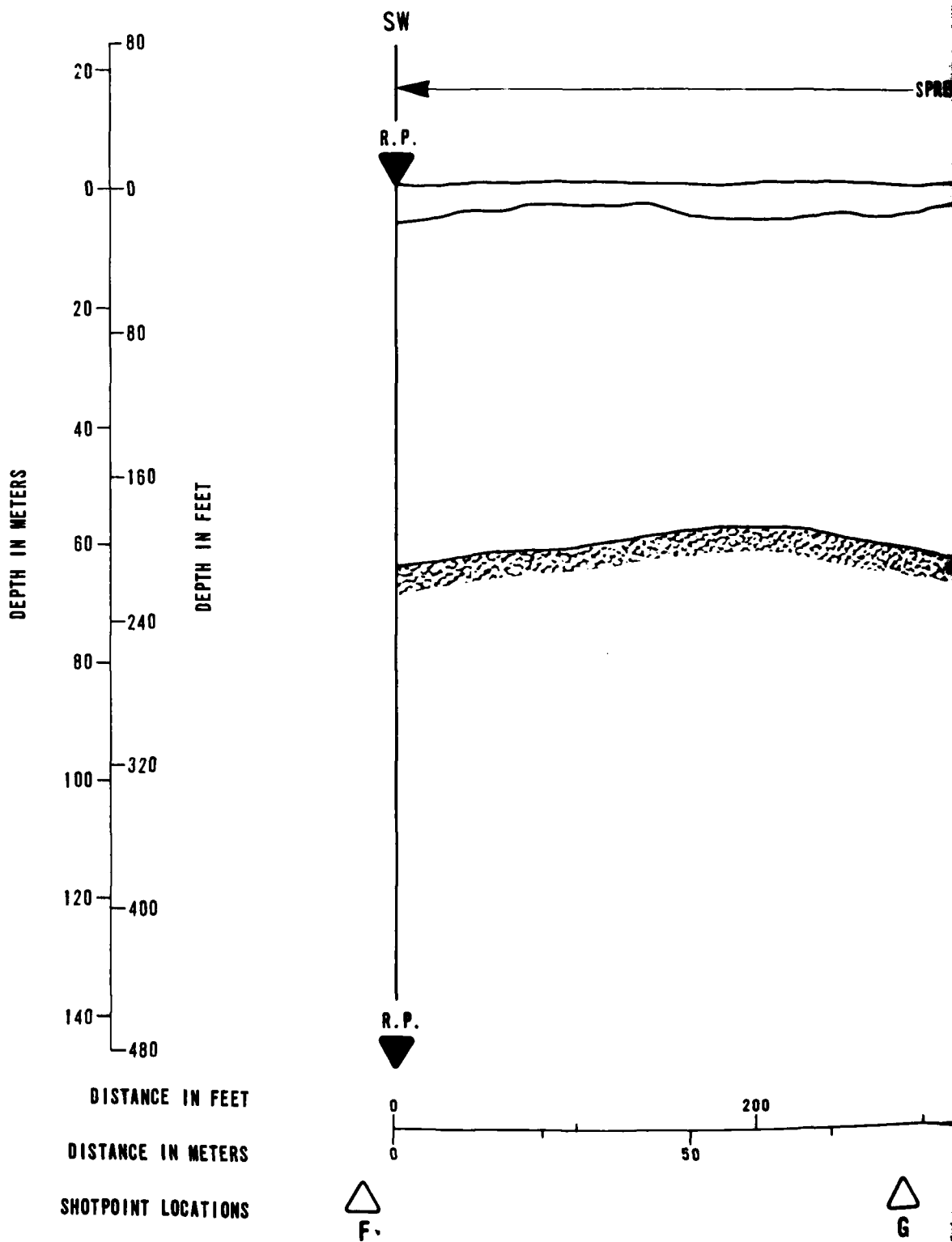
FIGURE
A-13

FUGRO NATIONAL, INC.

See page C-3 for explanation of Universal
Mercator Grid System.

4

CHECKED BY ——— 'PPRO' ———



VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-9

N 63 E



SPREAD A

SPREAD B

GROUND SURFACE

1500 ft sec (457 m sec)

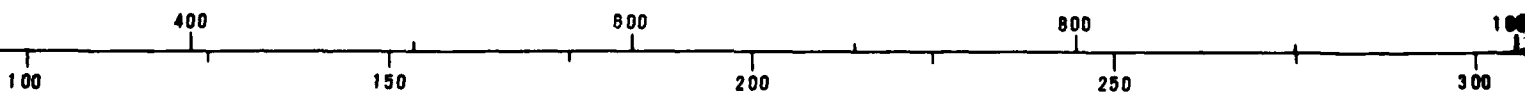
1500 ft sec (457 m sec)

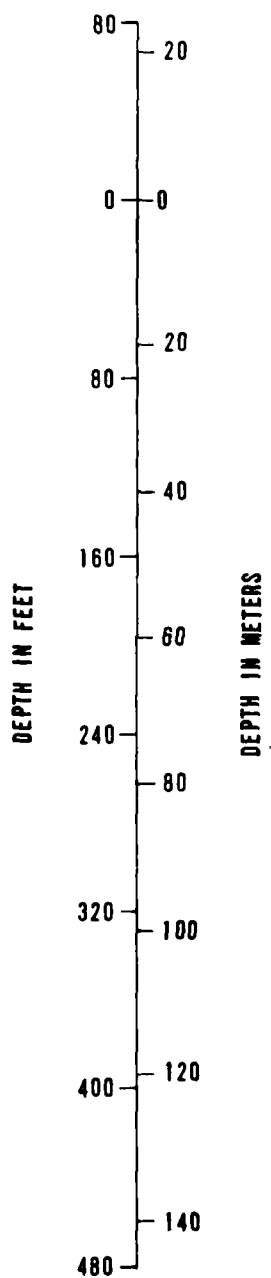
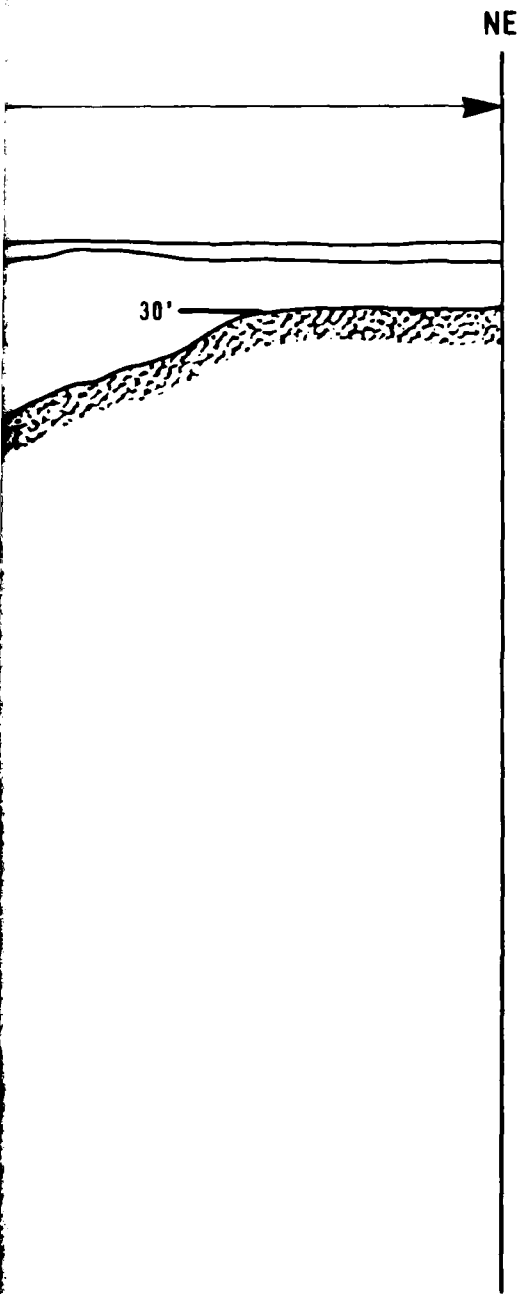
2800 ft sec (853 m sec)


100'

BASEMENT

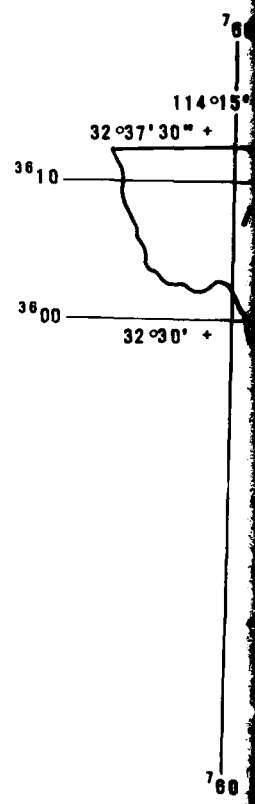
7600 ft sec (2316 m sec)





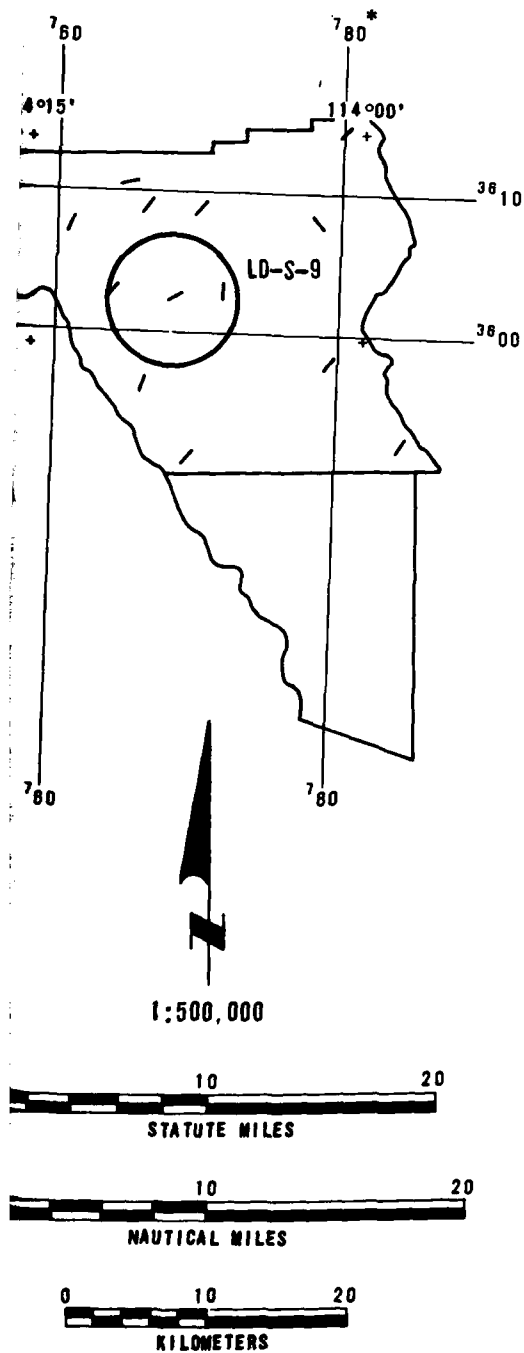
R.P.  - Reference point on the ground surface used as the zero datum on the depth scale.

No Vertical Exaggeration



*NOTE: See App. Trends

LOCATION MAP



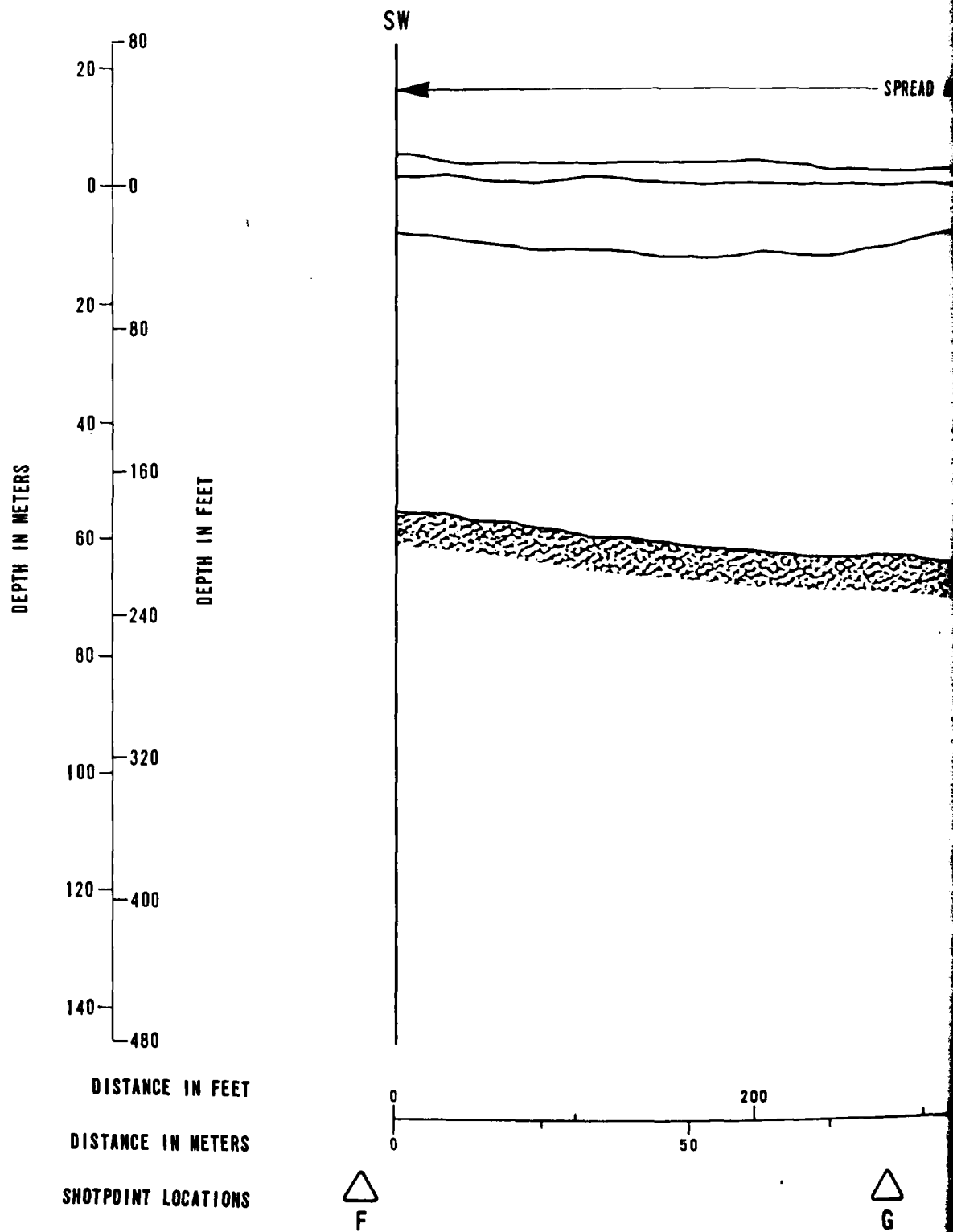
VELOCITY PROFILE LD-S-9
PERIMETER SEISMIC REFRACTION SURVEY
LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
A-14

FUGRO NATIONAL, INC.

CHART BY ———— 'PPRO' ————



VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-10

N 36 E



HEAD A

SPREAD B

1650 ft sec (503 m sec)

R.P.

GROUND SURFACE

3600 ft sec (1097 m sec)

5200 ft sec (1585 m sec)

BASEMENT

8200 ft sec (2499 m sec)

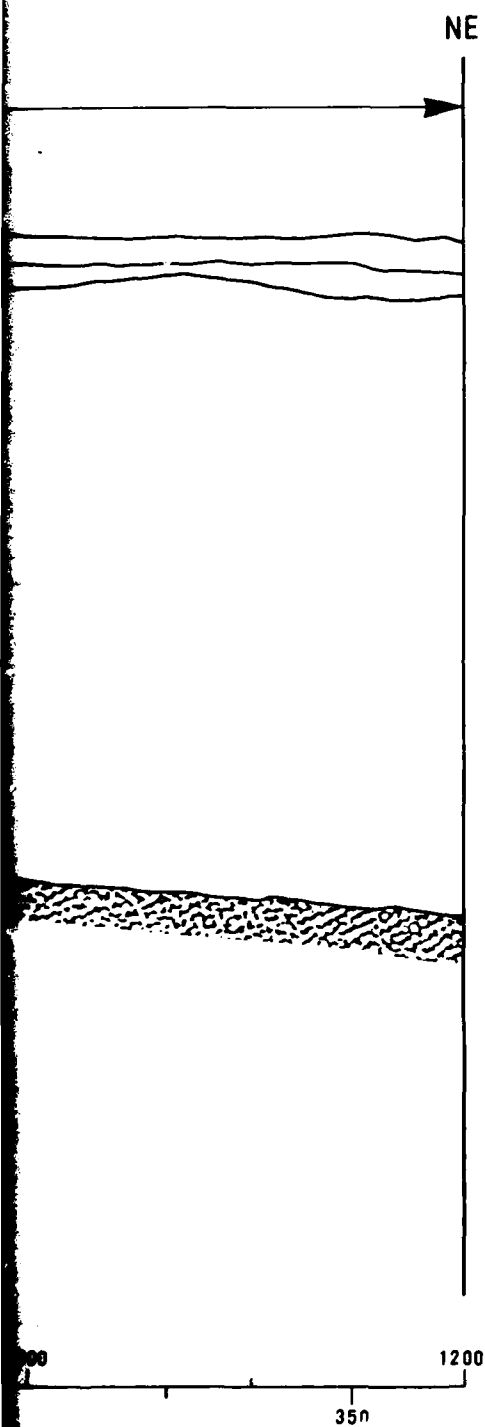
R.P.

100 400 150 600 200 800 250 1000 300

H

I

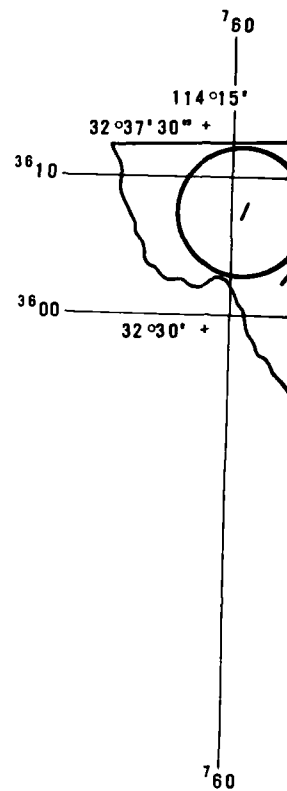
LOC



R.P.



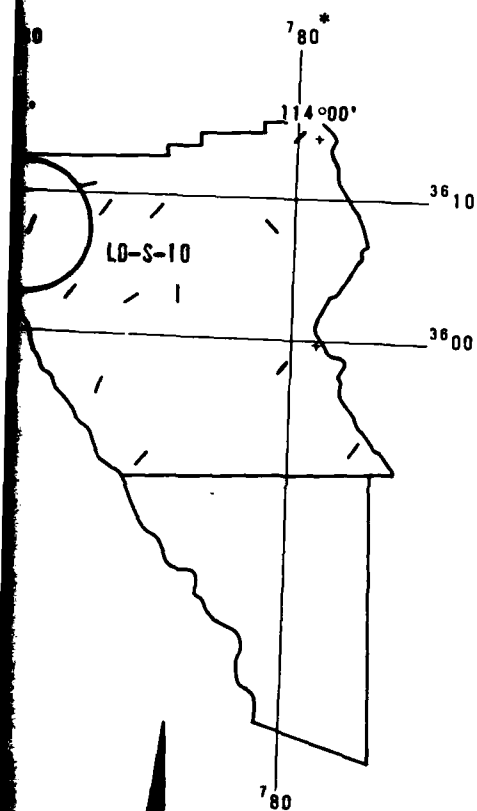
- Reference point on the ground surface used as the zero datum on the depth scale.



*NOTE: See Appendix Transverse

3

LOCATION MAP



1:500,000

10 20
STATUTE MILES

10 20
NAUTICAL MILES

10 20
KILOMETERS

VELOCITY PROFILE LD-S-10
PERIMETER SEISMIC REFRACTION SURVEY
LECHUGUILLA DESERT, ARIZONA

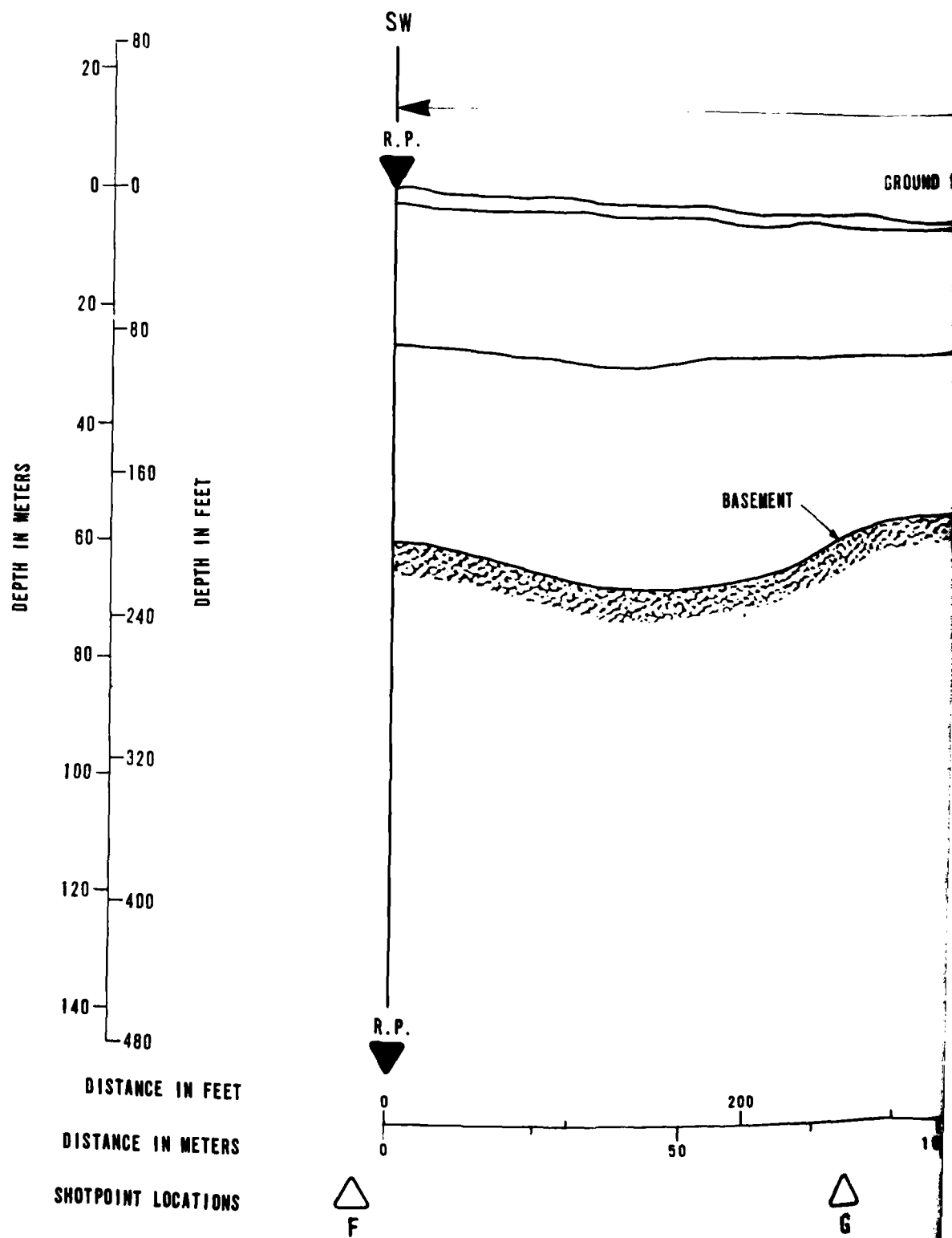
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SANSO

FIGURE
A-15

FUGRO NATIONAL, INC.

See page C-5 for explanation of Universal
Mercator Grid System.

CHART BY ——— PPRO Y ———



VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-11

N 54 E

SPREAD A

GROUND SURFACE

1400 ft sec (427 m sec)

3750 ft sec (1143 m sec)

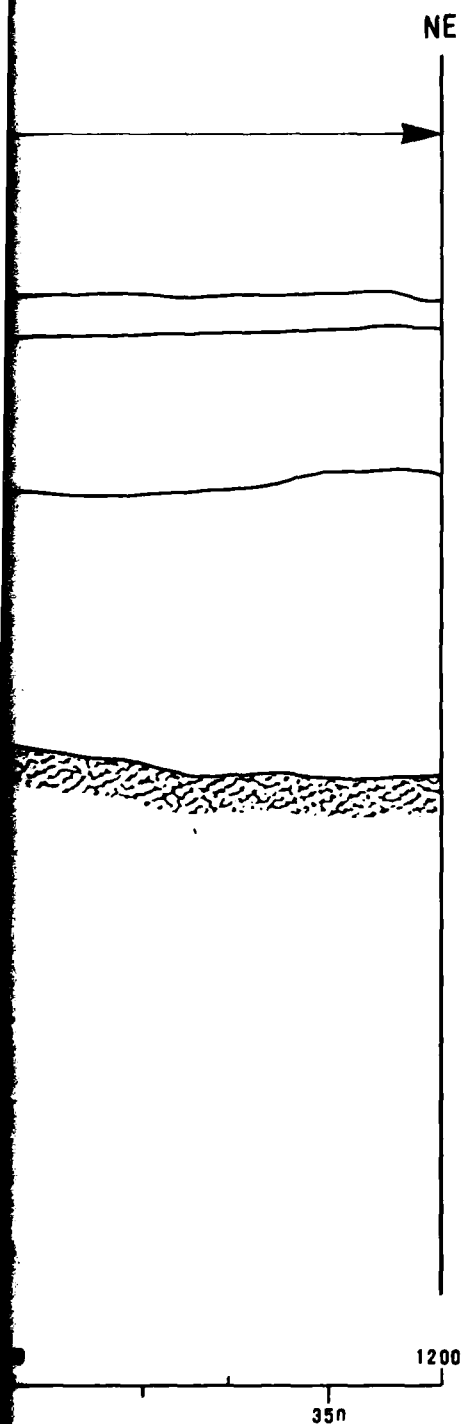
5750 ft sec (1753 m sec)

10550 ft sec (3216 m sec)

400 600 800 1000
100 150 200 250 300



LOCA

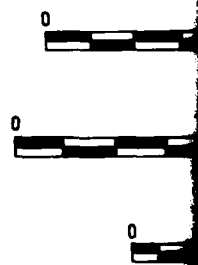
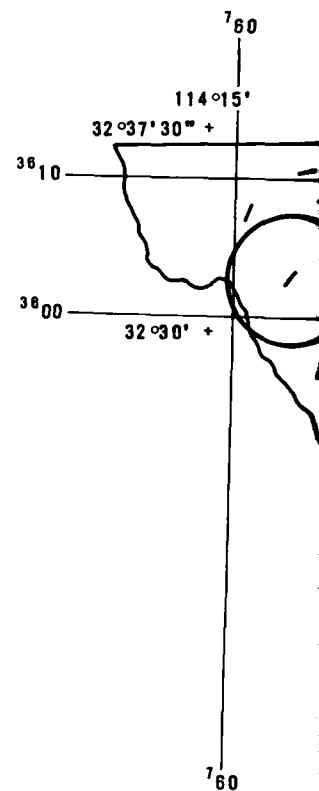


R.P.



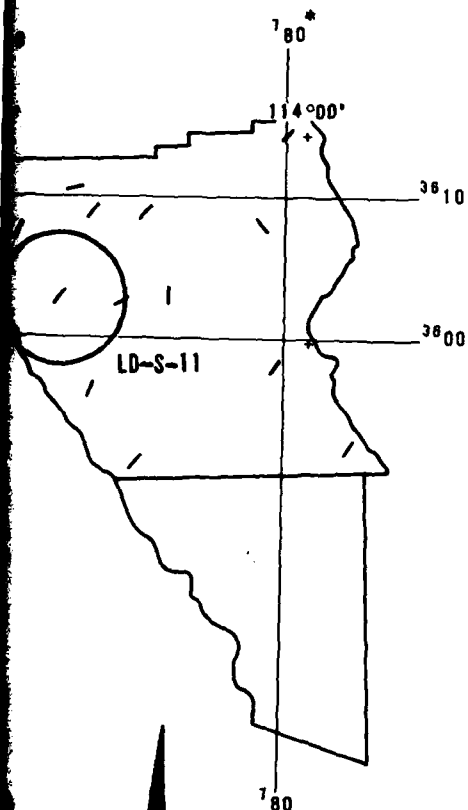
- Reference point on the ground surface used as the zero datum on the depth scale.

No Vertical Exaggeration



*NOTE: See Appendix Transverse

LOCATION MAP



1:500,000

10 20
STATUTE MILES

10 20
NAUTICAL MILES

0 10 20
KILOMETERS

VELOCITY PROFILE LD-S-11
PERIMETER SEISMIC REFRACTION SURVEY
LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

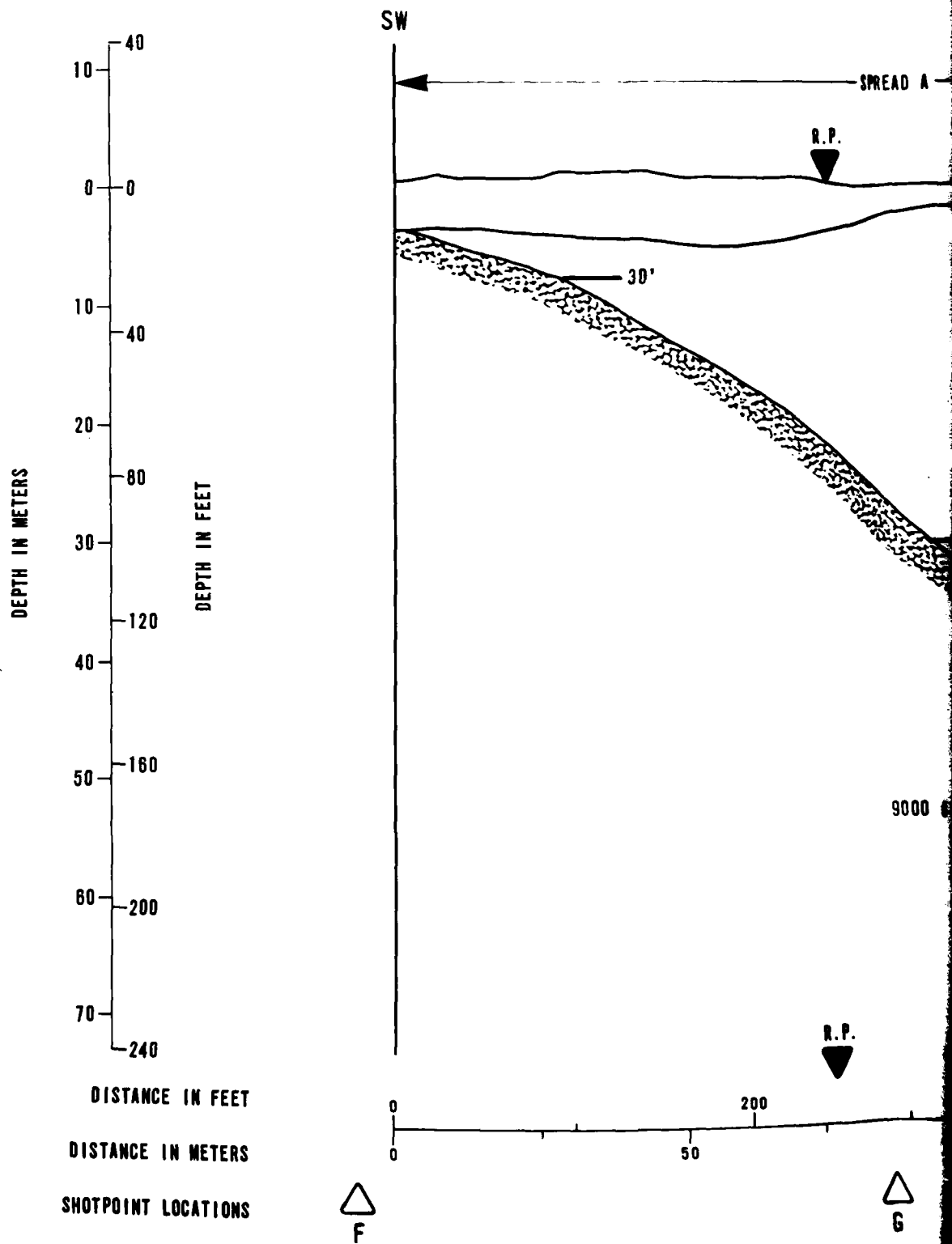
FIGURE
A-16

FUGRO NATIONAL, INC.

Index page C-5 for explanation of Universal
Tee Mercator Grid System.

4

APPROVED BY



VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-12

N 17 E



SPREAD 8

GROUND SURFACE

1500 ft sec (457 m sec)

3050 ft sec (930 m sec)

100'

BASEMENT

/sec (2743 m sec)

400

150

800

200

800

250

1000

300



LOCATION

NE

LO-B-11

SM
SC
SM
SC
SM
SC
SM
SC
SM
SC
SM
SC
SW SC

TD 101.5'
(30.9m)

DEPTH IN FEET

DEPTH IN METERS

40
10
0
0
10
40
20
80
30
120
40
160
50
200
60
240
70

R.P.



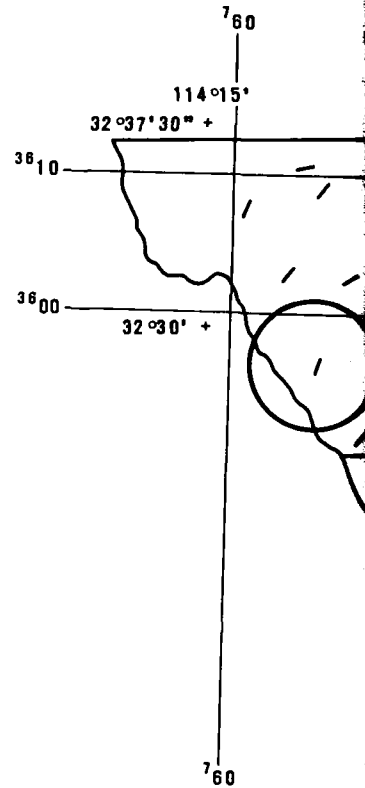
- Reference point on the ground surface used as the zero datum on the depth scale.

Vertical Exaggeration: 2X



1200

350



1:5

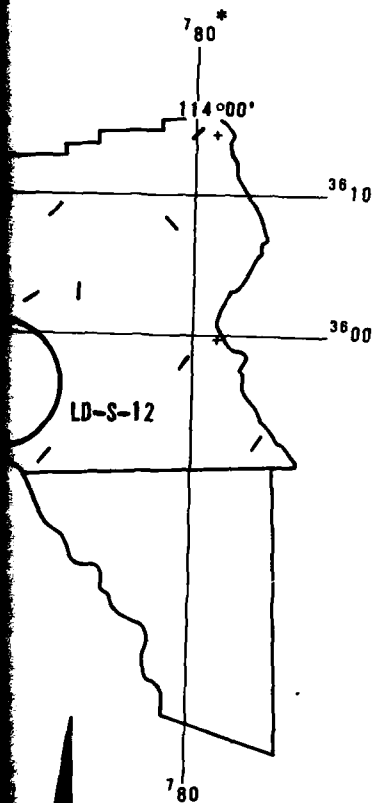
0
STA

0
NAUT

0
KI

*NOTE: See Appendix page 6
Transverse Mercate

ION MAP



1:500,000

10 20
STATUTE MILES

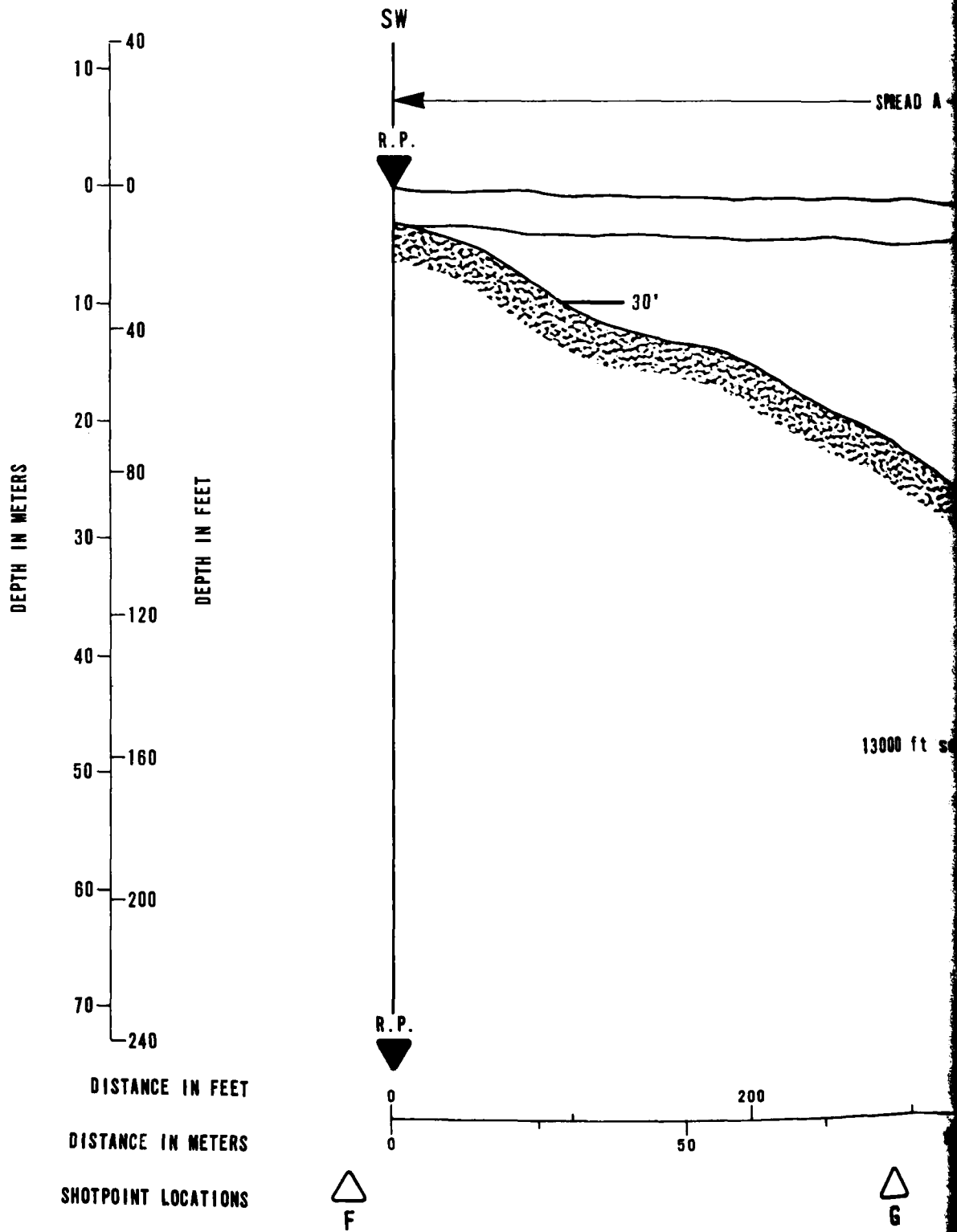
10 20
Nautical Miles

10 20
KILOMETERS

See C-5 for explanation of Universal
Grid System.

<p>VELOCITY PROFILE LD-S-12 PERIMETER SEISMIC REFRACTION SURVEY LECHUGUILLA DESERT, ARIZONA</p>	
<p>MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMSO</p>	<p>FIGURE A-17</p>
<p>FUGRO NATIONAL, INC.</p>	

APPROVED BY



VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-13

N 46 E



A



SPREAD B

GROUND SURFACE

1850 ft sec (564 m sec)

3300 ft sec (1006 m sec)

100'

sec (3962 m sec)

BASEMENT

400

600

800

1000

100

150

200

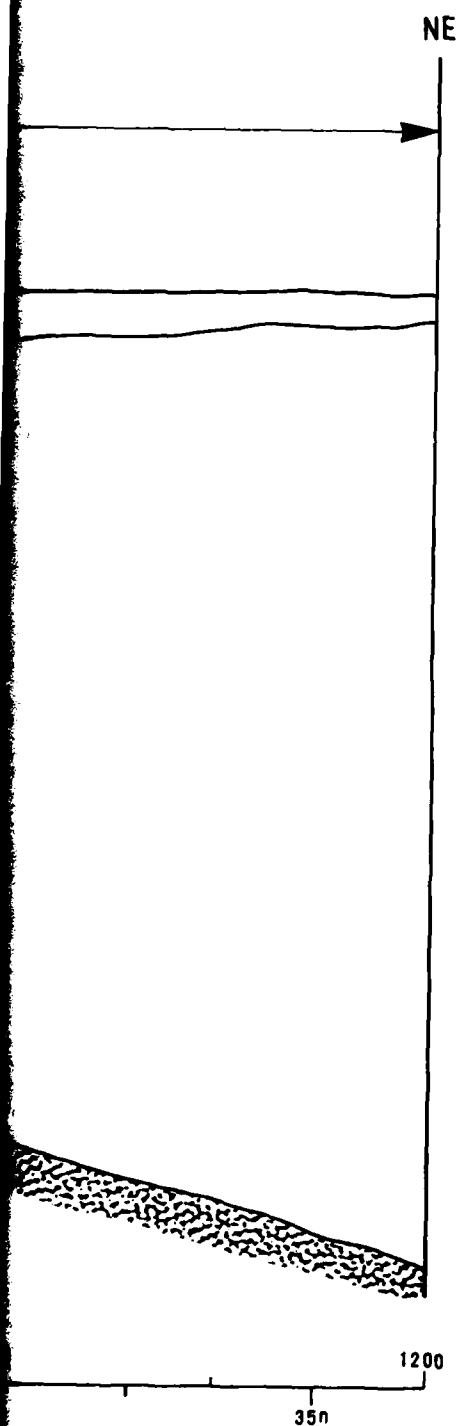
250

300



2

LOCAT

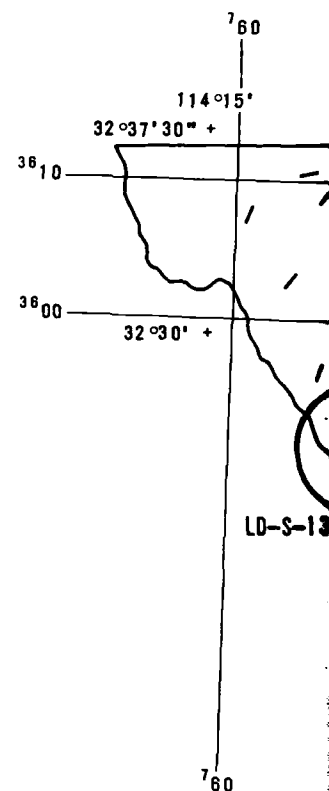


J



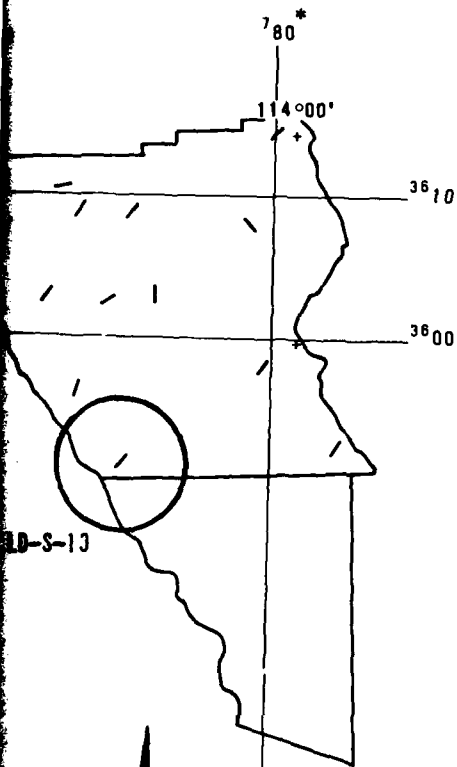
R.P. - Reference point on the ground surface used as the zero datum on the depth scale.

Vertical Exaggeration: 2X



*NOTE: See Appendix for Transverse Mercator

LOCATION MAP



1:500,000



STATUTE MILES



NAUTICAL MILES



KILOMETERS

VELOCITY PROFILE LD-S-13
PERIMETER SEISMIC REFRACTION SURVEY
LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSQ

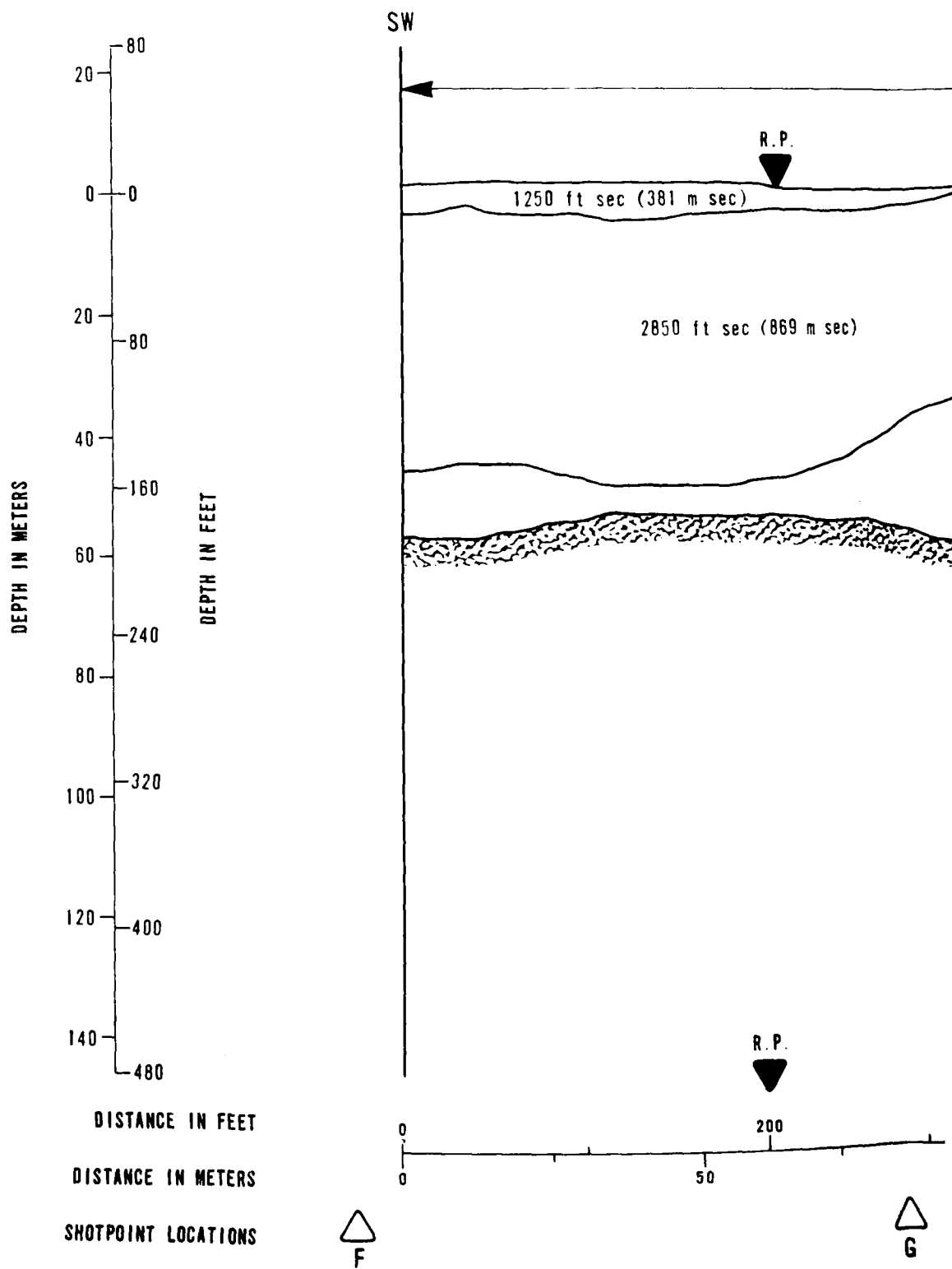
FIGURE
A-18

FUGRO NATIONAL, INC.

Index page C-5 for explanation of Universal
Mercator Grid System.

4

CH 1 BY PRO



VELOCITY PROFILE SEISMIC REFRACTION LINE LD-S-14

N 67 E

SPREAD A

1250 ft sec (381 m sec)

GROUND SURFACE

1250

4500 ft sec (1372 m sec)

BASEMENT

9400 ft sec (2865 m sec)

400

800

800

1000

100

150

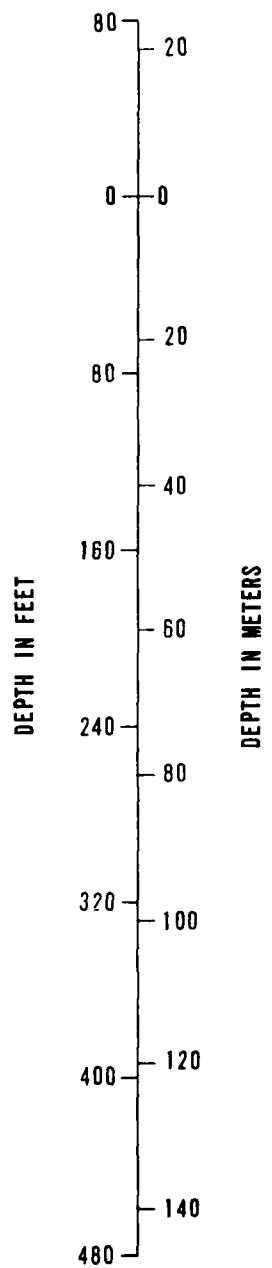
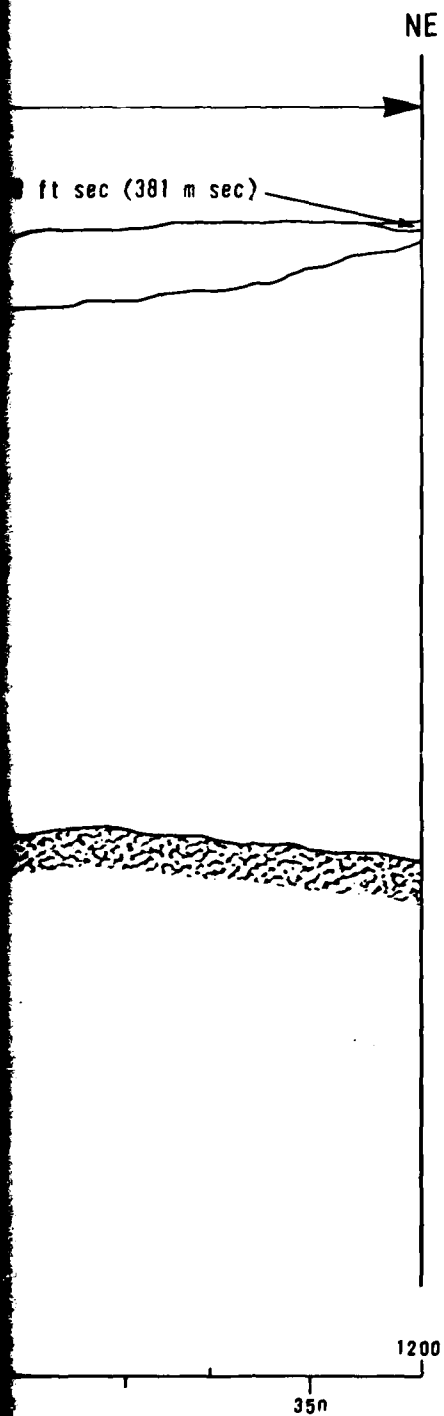
200

250

300

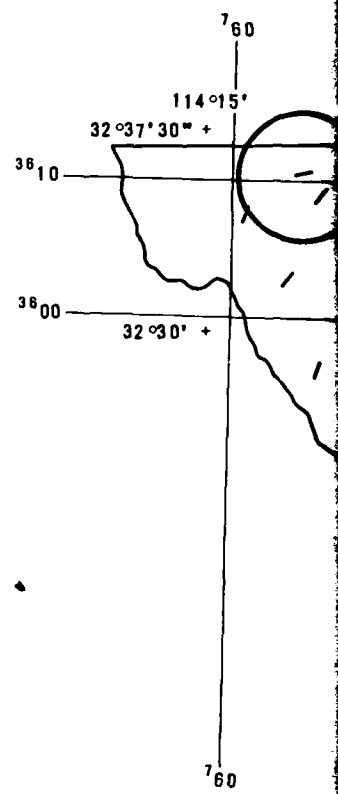


LOCAT



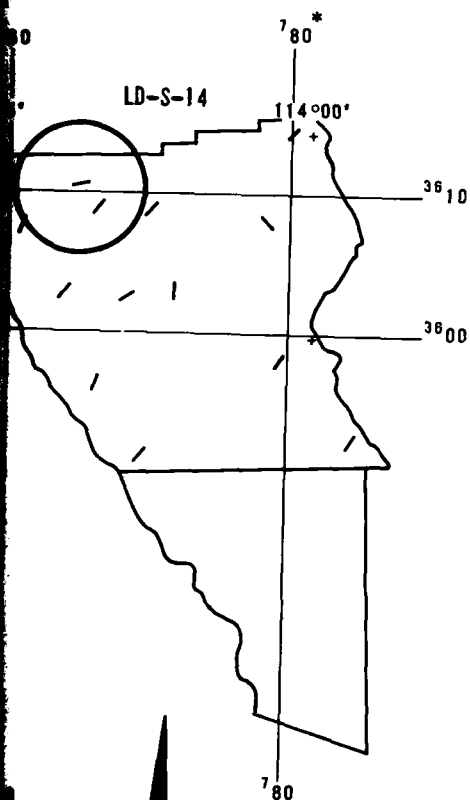
R.P. - Reference point on the ground surface used as the zero datum on the depth scale.

No Vertical Exaggeration



*NOTE: See Appendix B Transverse Map

LOCATION MAP



1:500,000



See page C-5 for explanation of Universal
Mercator Grid System.

VELOCITY PROFILE LD-S-14
PERIMETER SEISMIC REFRACTION SURVEY
LECHUGUILLA DESERT, ARIZONA

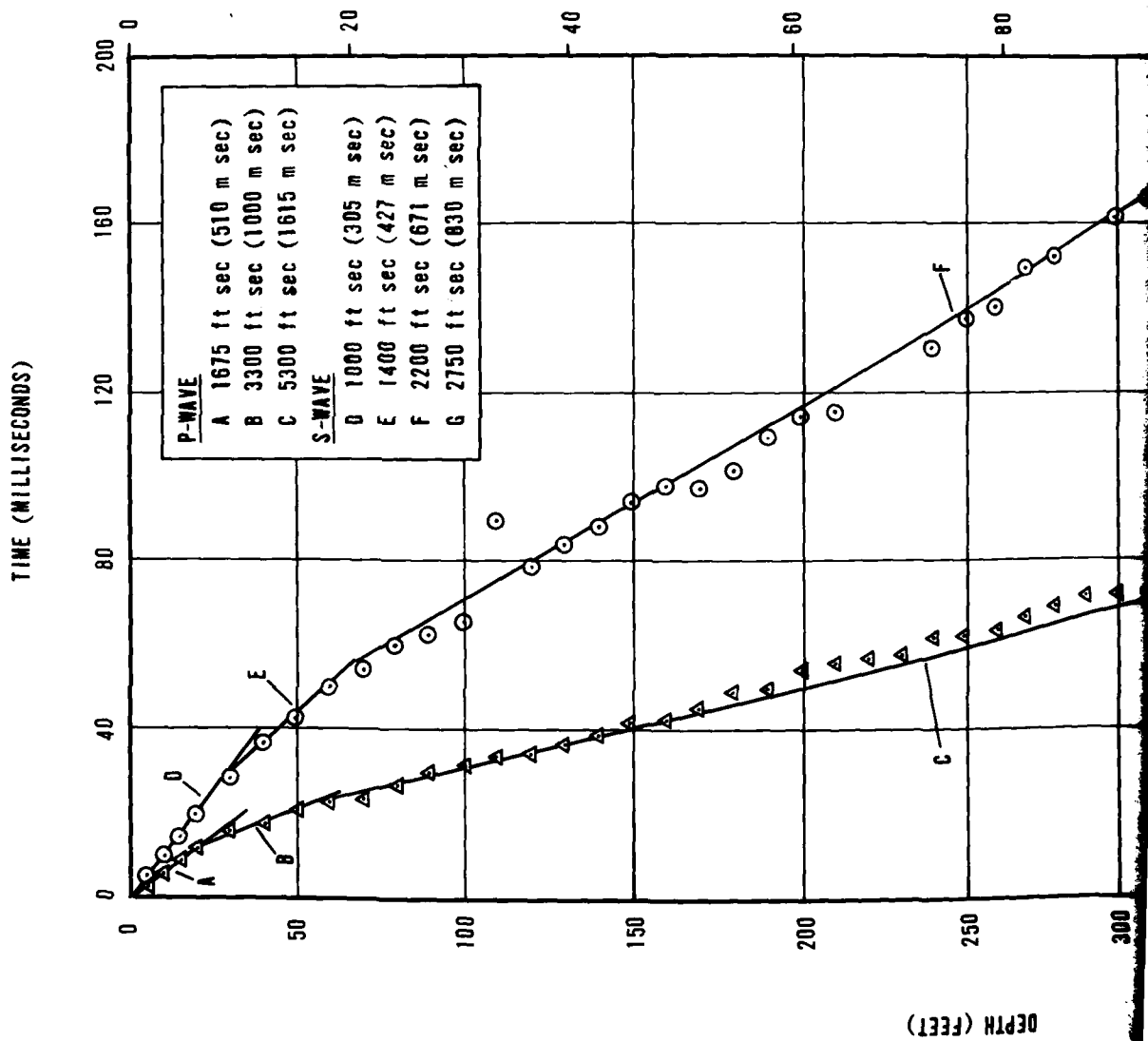
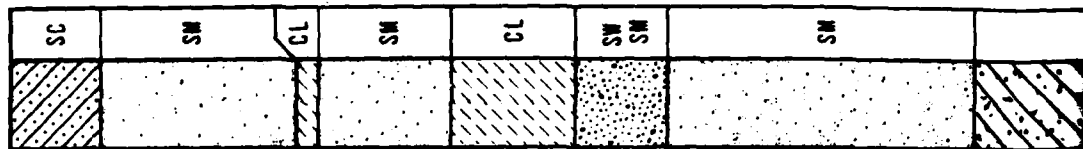
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

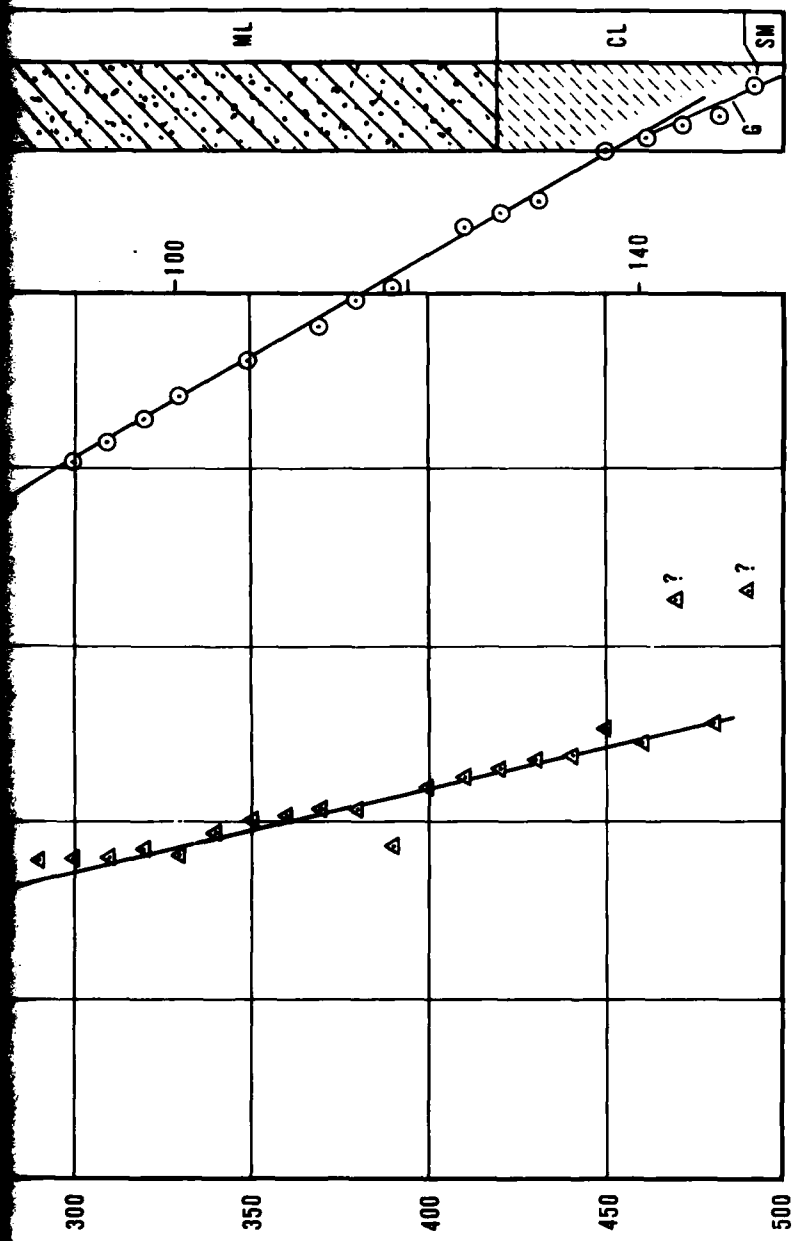
FIGURE
A-19

FUGRO NATIONAL, INC.

CHECKED BY _____ APPROVED BY _____

LITHOLOGY
USCS SYMBOL



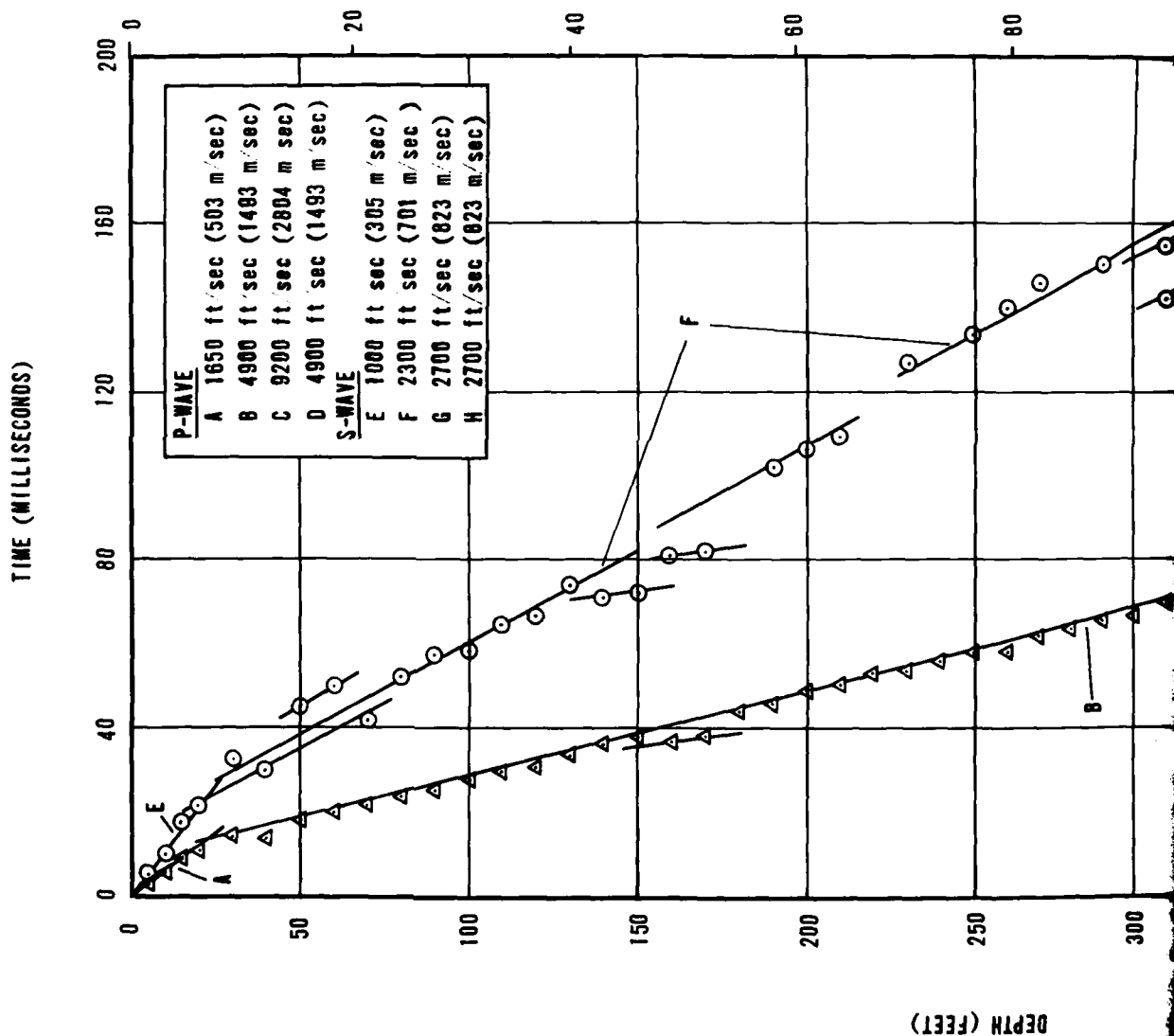


EXPLANATION

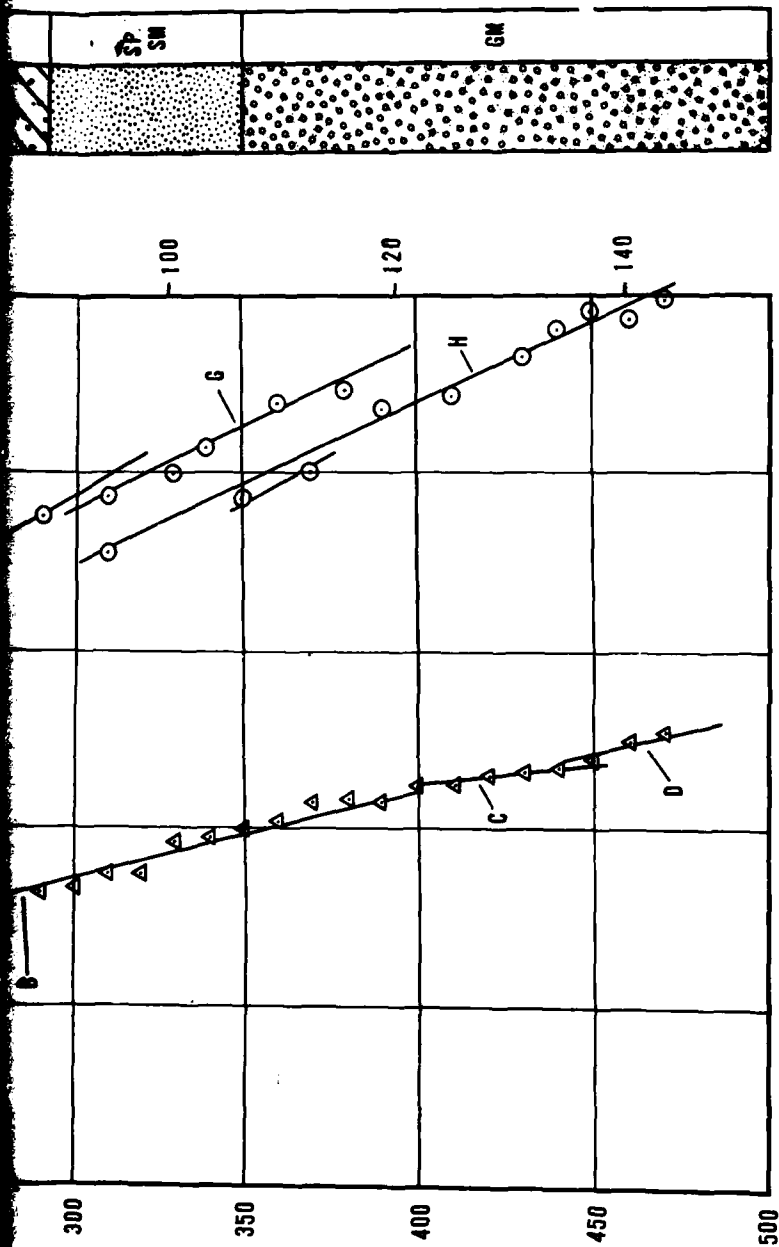
- △ COMPRESSIONAL WAVE DATA
- SHEAR WAVE DATA

DOWNHOLE VELOCITY DATA LOG OF BORING LD-D-1 LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMS0	FIGURE A-20
VERO NATIONAL INC.	

USCS SYMBOL
LITHOLOGY



CHECKED BY _____ APPROVED BY _____



EXPLANATION

△ COMPRESSIONAL WAVE DATA

○ SHEAR WAVE DATA

DOWNHOLE VELOCITY DATA
LOG OF BORING LD-0-2
LECHUGUILLA DESERT, ARIZONA

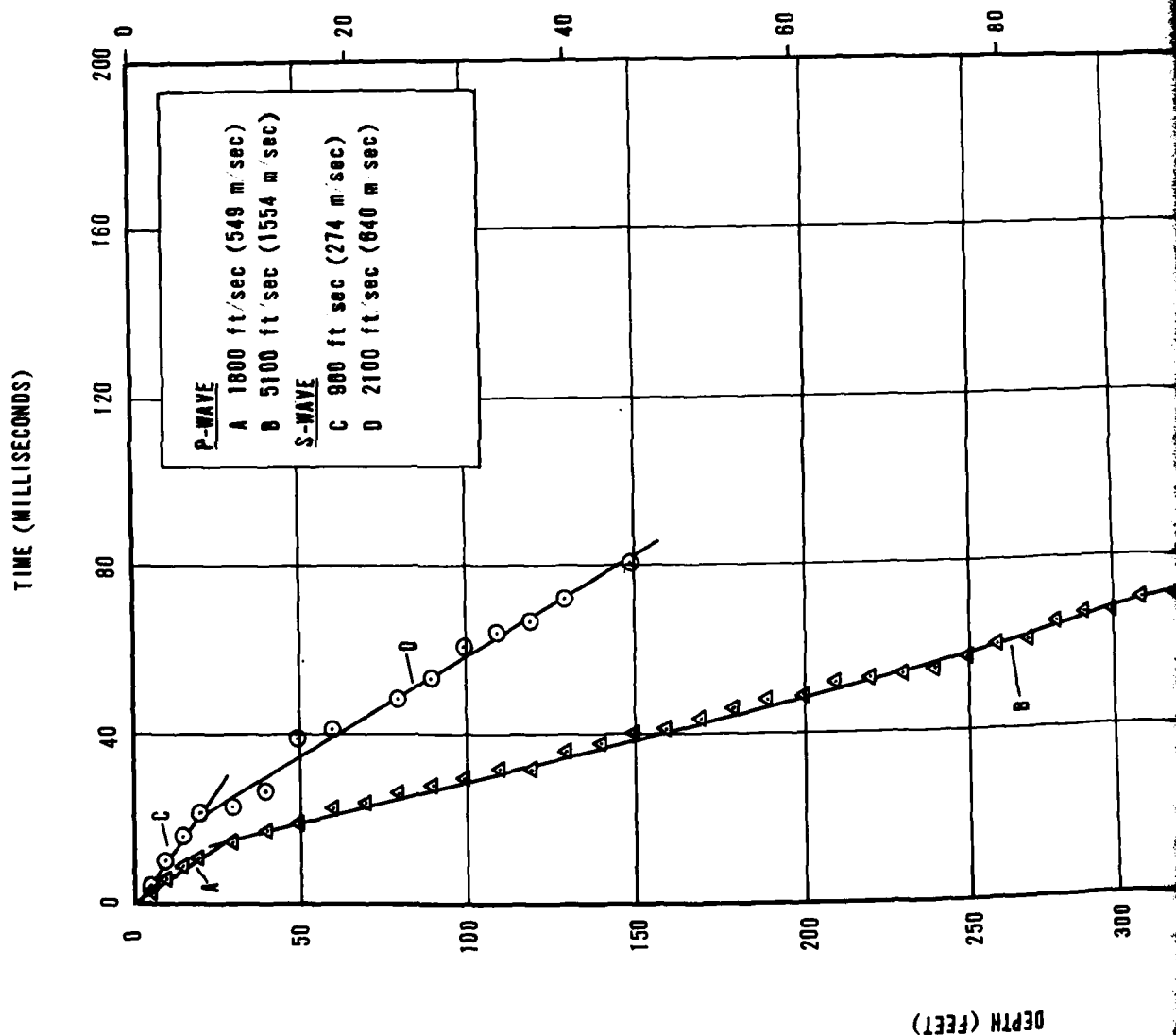
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

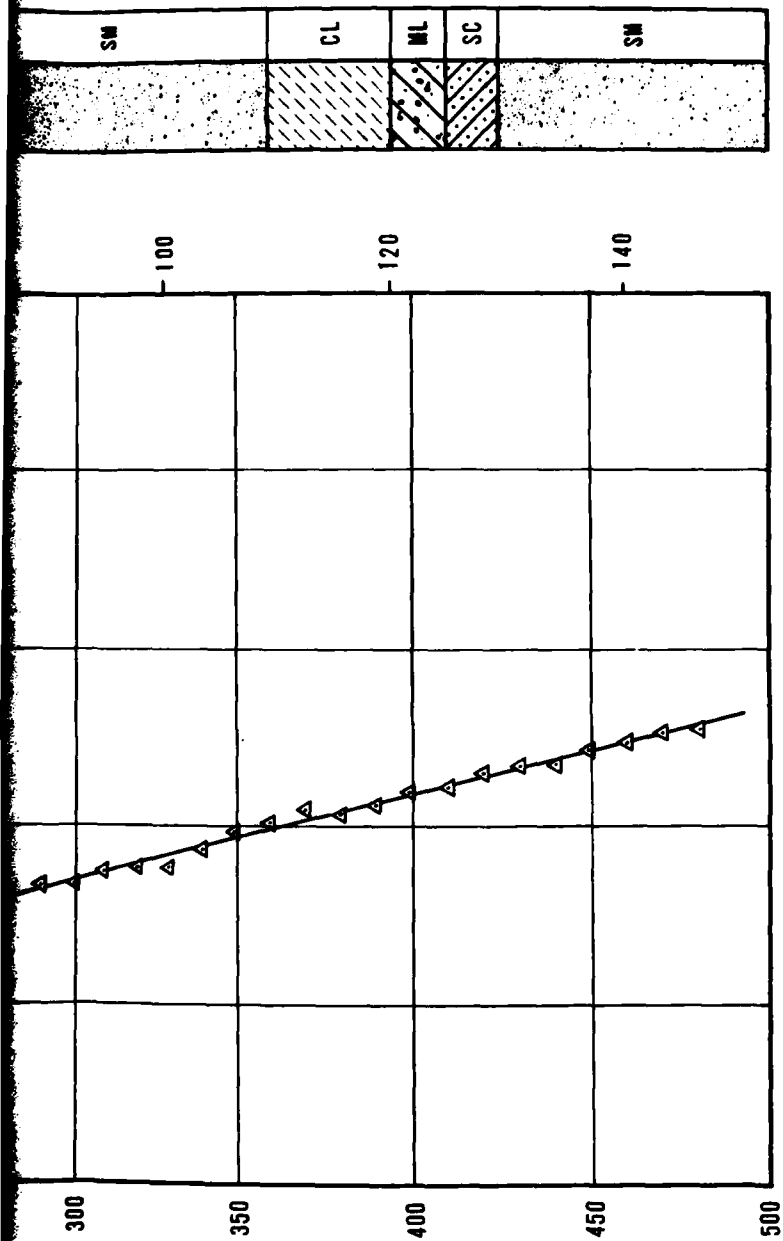
FIGURE
A-21

FLUORO NATIONAL, INC.

CHECKED BY _____ APPROVED BY _____

LITHOLOGY	USCS SYMBOL
Diagonal lines (top-left to bottom-right)	SC
Stippled pattern	SM
Diagonal lines (bottom-left to top-right)	SC
Stippled pattern	SM
Stippled pattern	SM
Stippled pattern	SM
Stippled pattern	SM
Stippled pattern	SM
Stippled pattern	SM
Diagonal lines (top-left to bottom-right)	SC
Stippled pattern	SM





EXPLANATION

△ COMPRESSIONAL WAVE DATA

○ SHEAR WAVE DATA

DOWNHOLE VELOCITY DATA
LOG OF BORING LD-0-3
LECHUGUILLA DESERT, ARIZONA

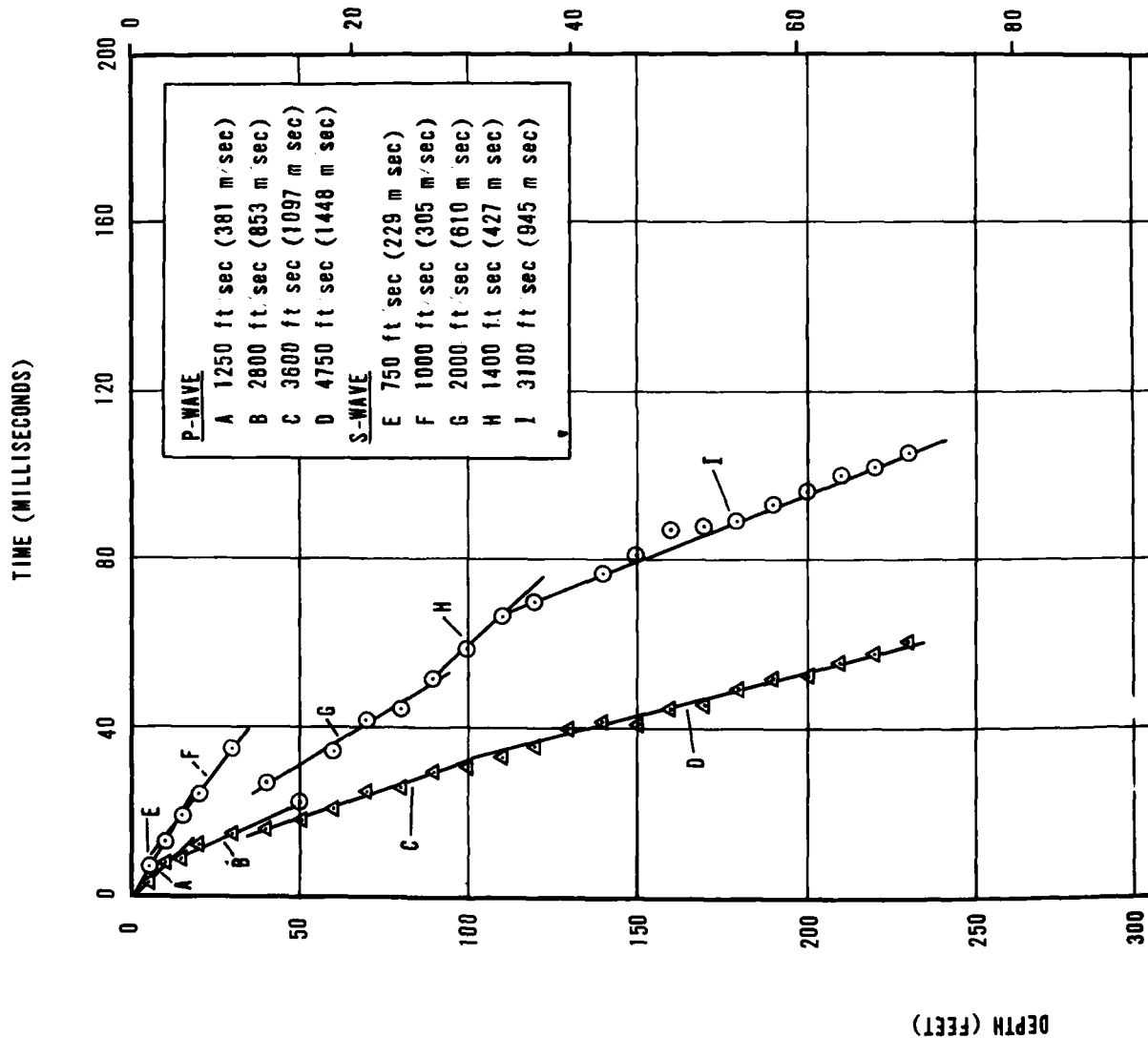
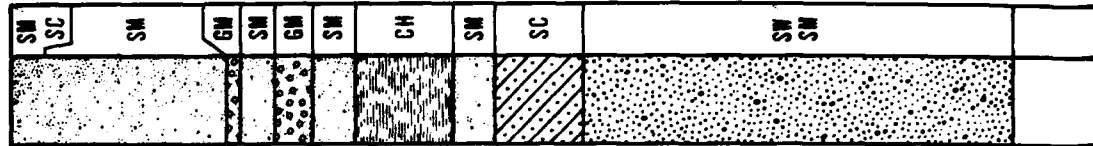
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SANSO

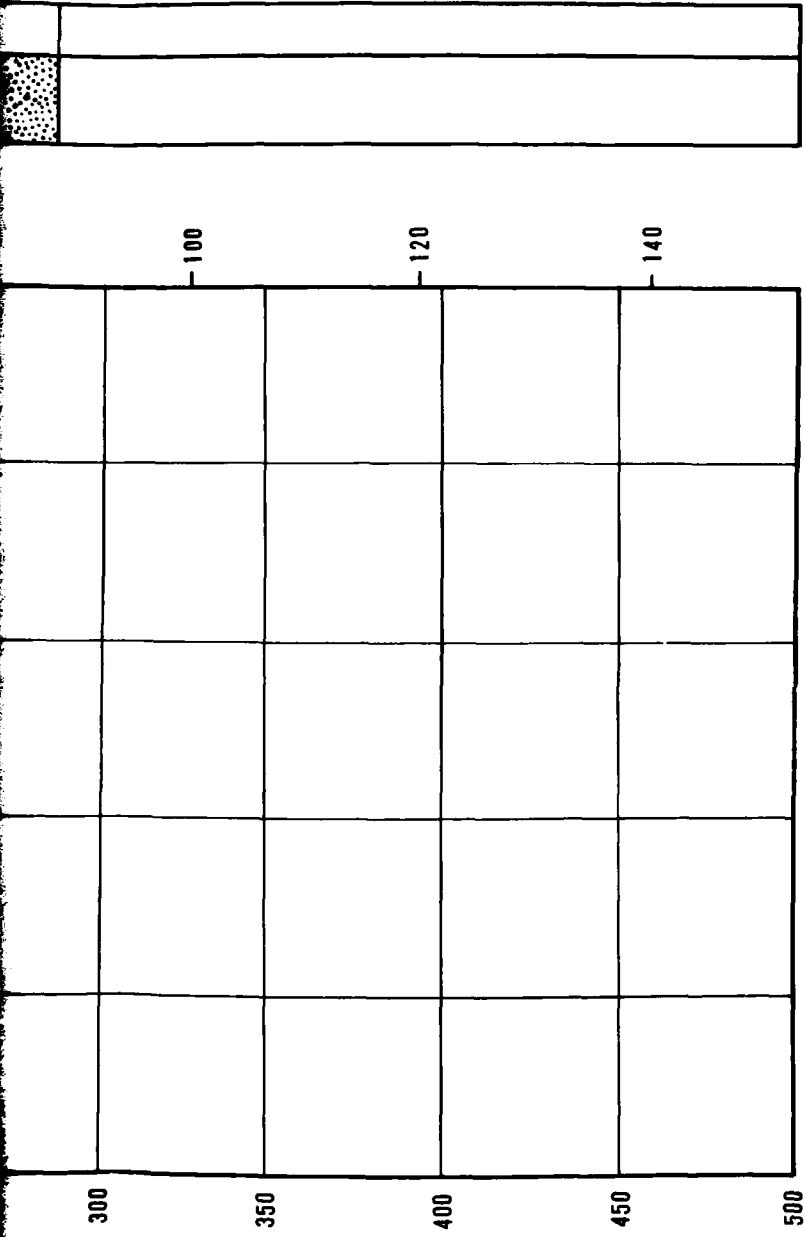
FIGURE
A-22

FUGRO NATIONAL INC.

CHECKED BY _____ APPROVED BY _____

LITHOLOGY
USCS SYMBOL





EXPLANATION

△ COMPRESSIONAL WAVE DATA

○ SHEAR WAVE DATA

DOWNHOLE VELOCITY DATA
LOG OF BORING LD-C-1
LECHUGUILLA DESERT, ARIZONA

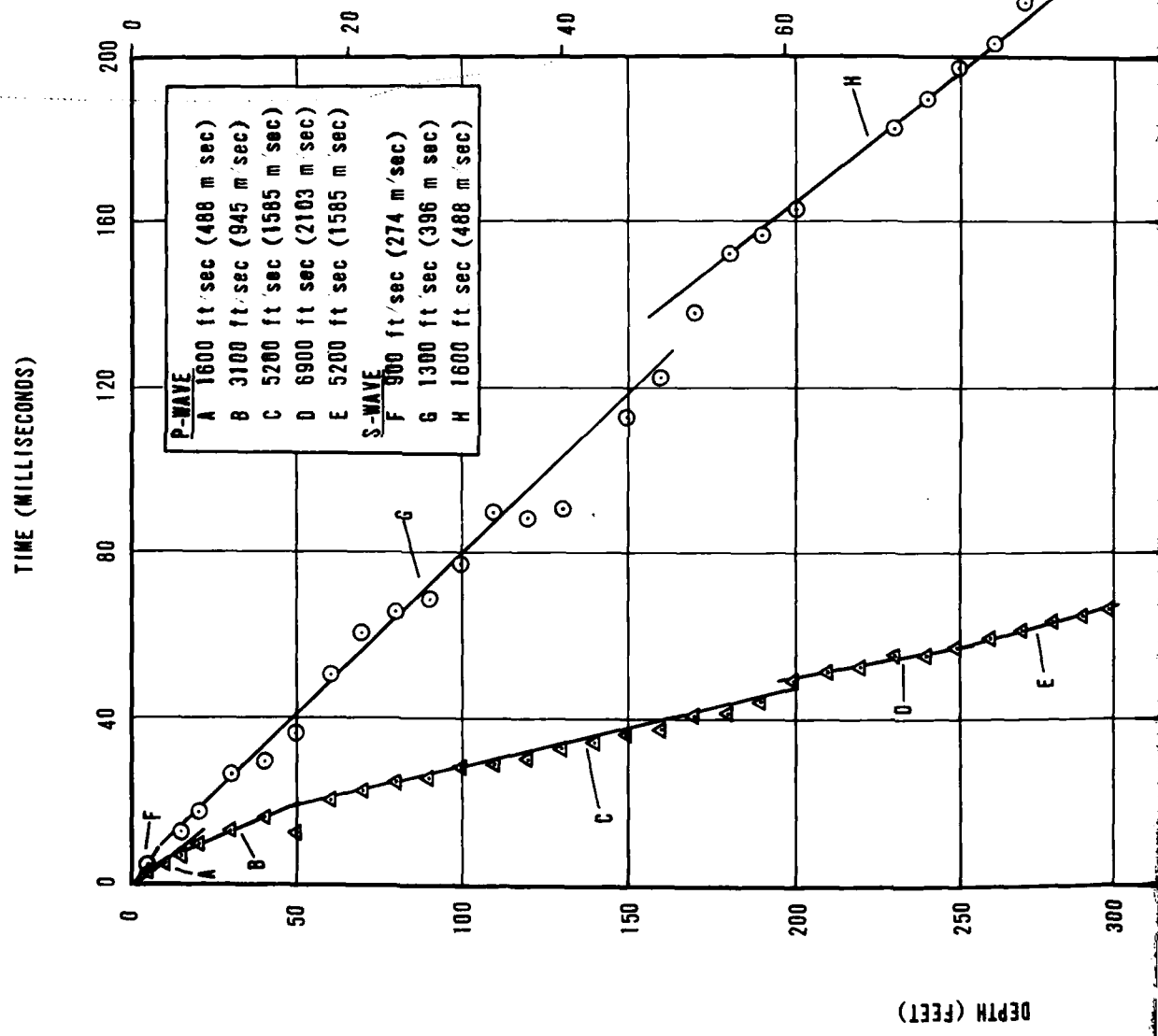
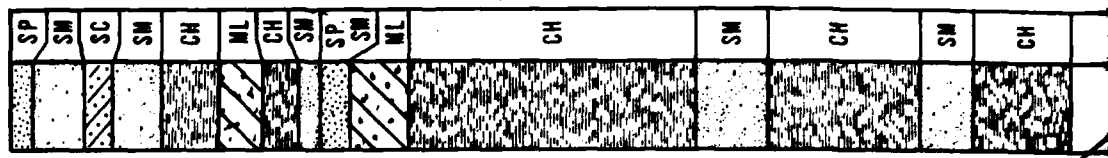
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSQ

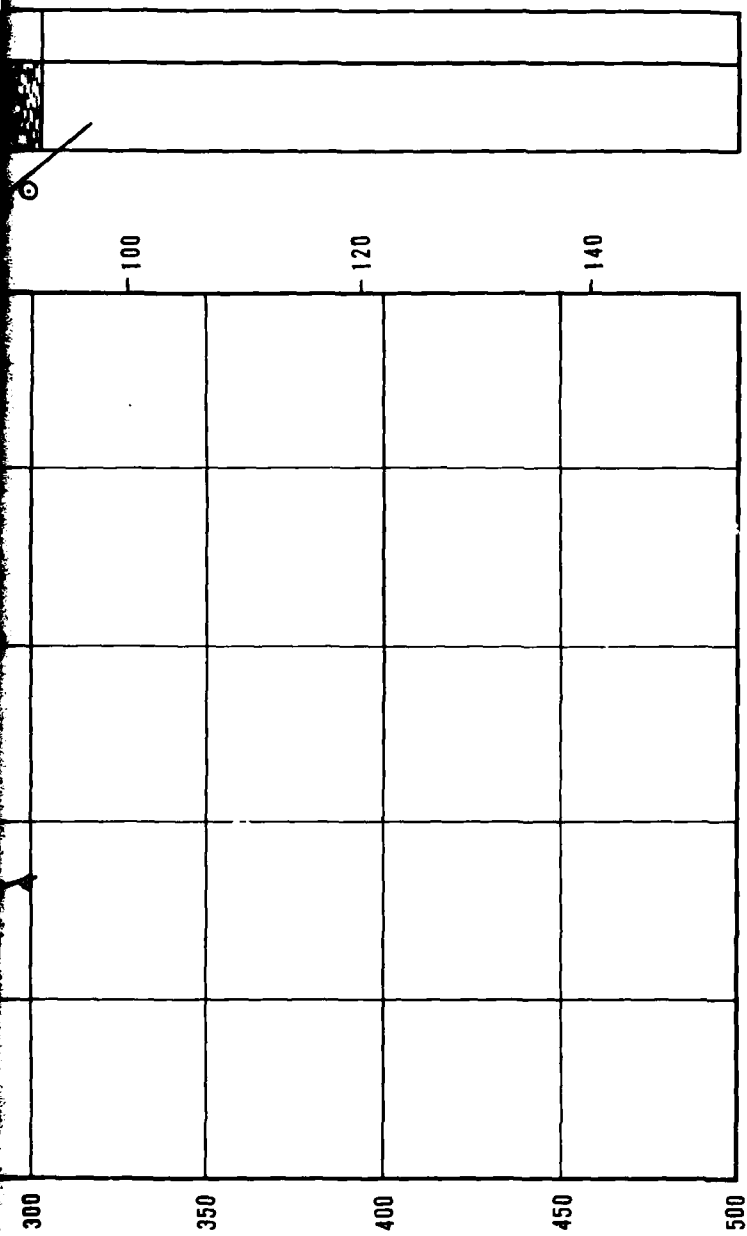
FIGURE
A-23

FUGRO NATIONAL INC.

CHSEVEN BY. — — — — —

LITHOLOGY
USCS SYMBOL





EXPLANATION

△ COMPRESSIONAL WAVE DATA

○ SHEAR WAVE DATA

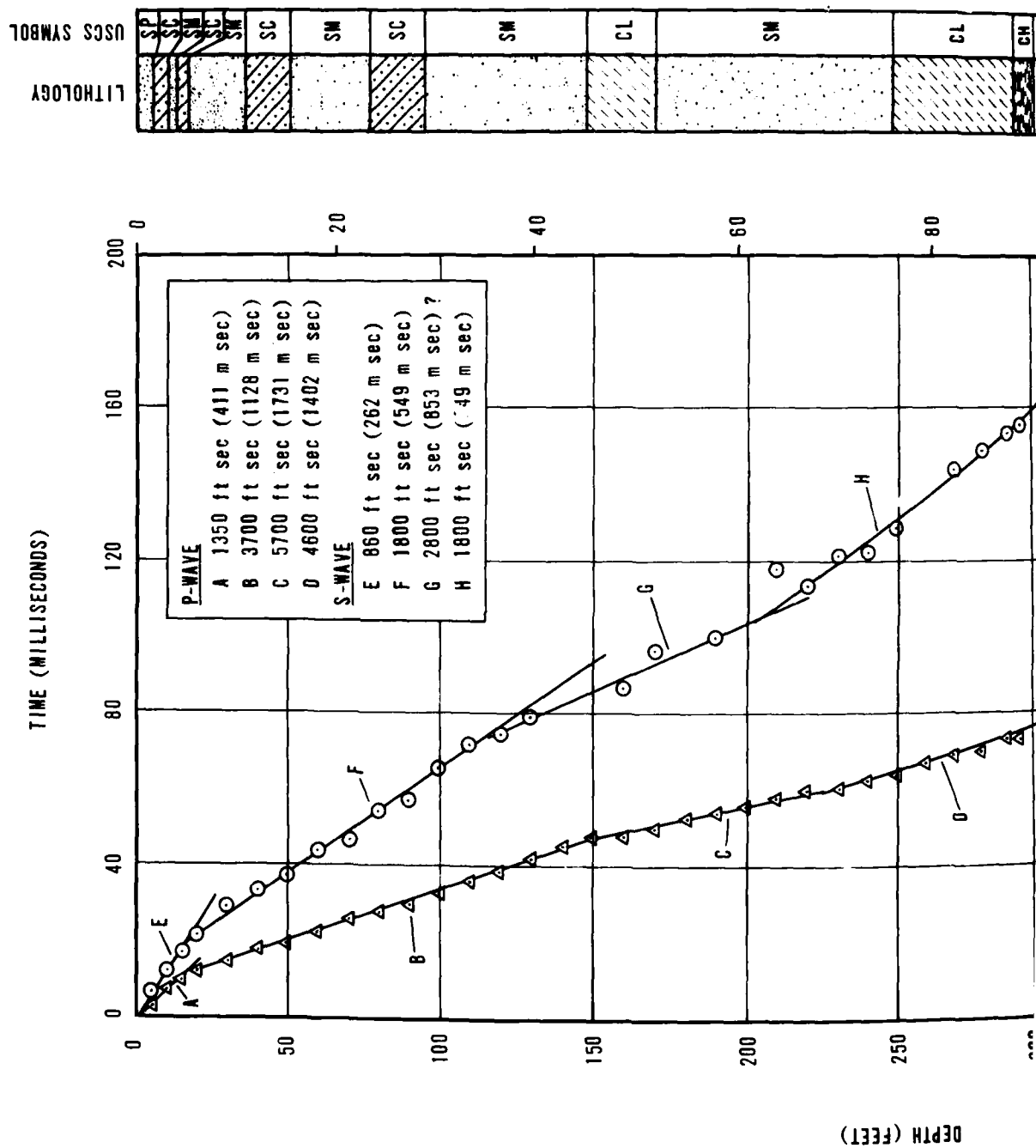
DOWNHOLE VELOCITY DATA
LOG OF BORING LD-C-2
LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
A-24

FUGRO NATIONAL, INC.

2



AD-A113 448

FUGRO NATIONAL INC LONG BEACH CA
MX SITING INVESTIGATION. GEOTECHNICAL EVALUATION OF LUKE BOMBIN--ETC(U)
JAN 78
FN-YR-19D-VOL-2-APP-A

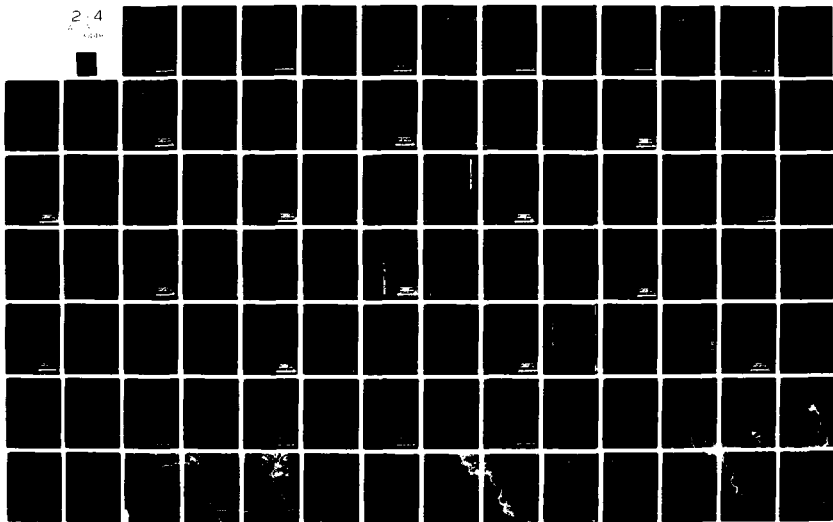
F/G 8/7

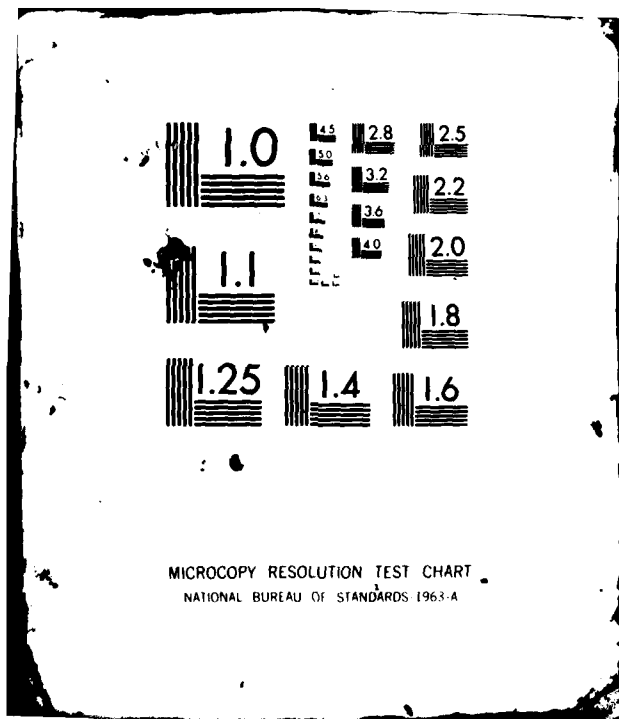
F04704-77-C-0010

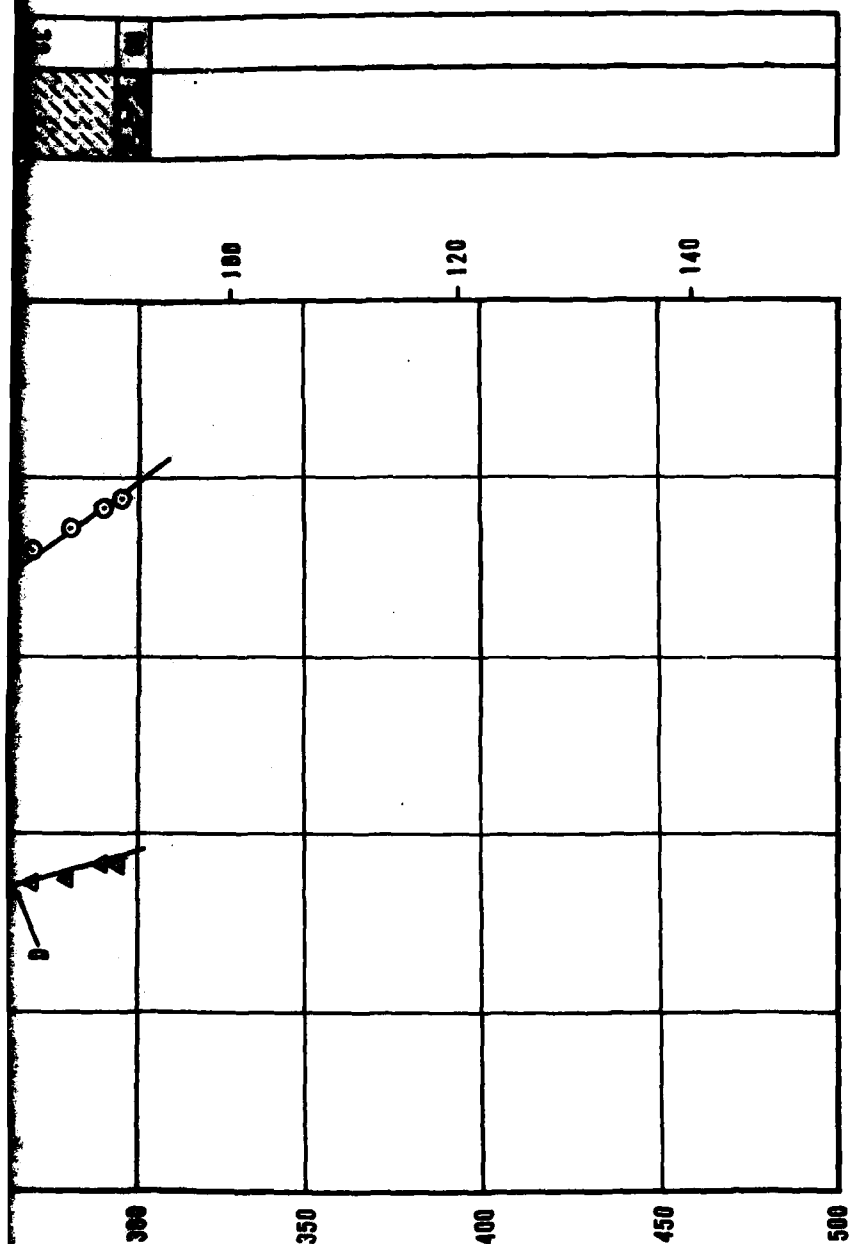
NL

UNCLASSIFIED

2.4
A
Code



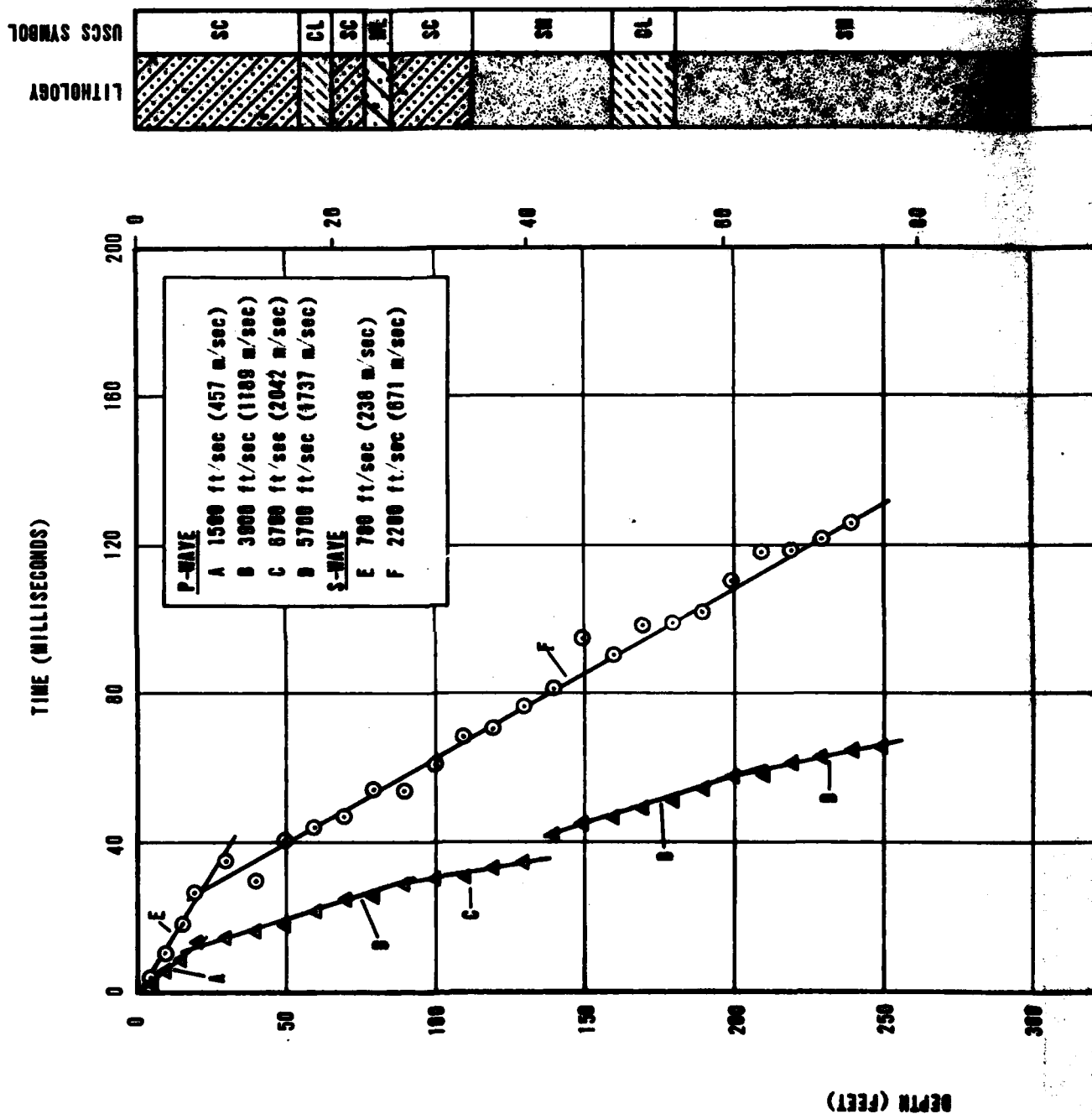


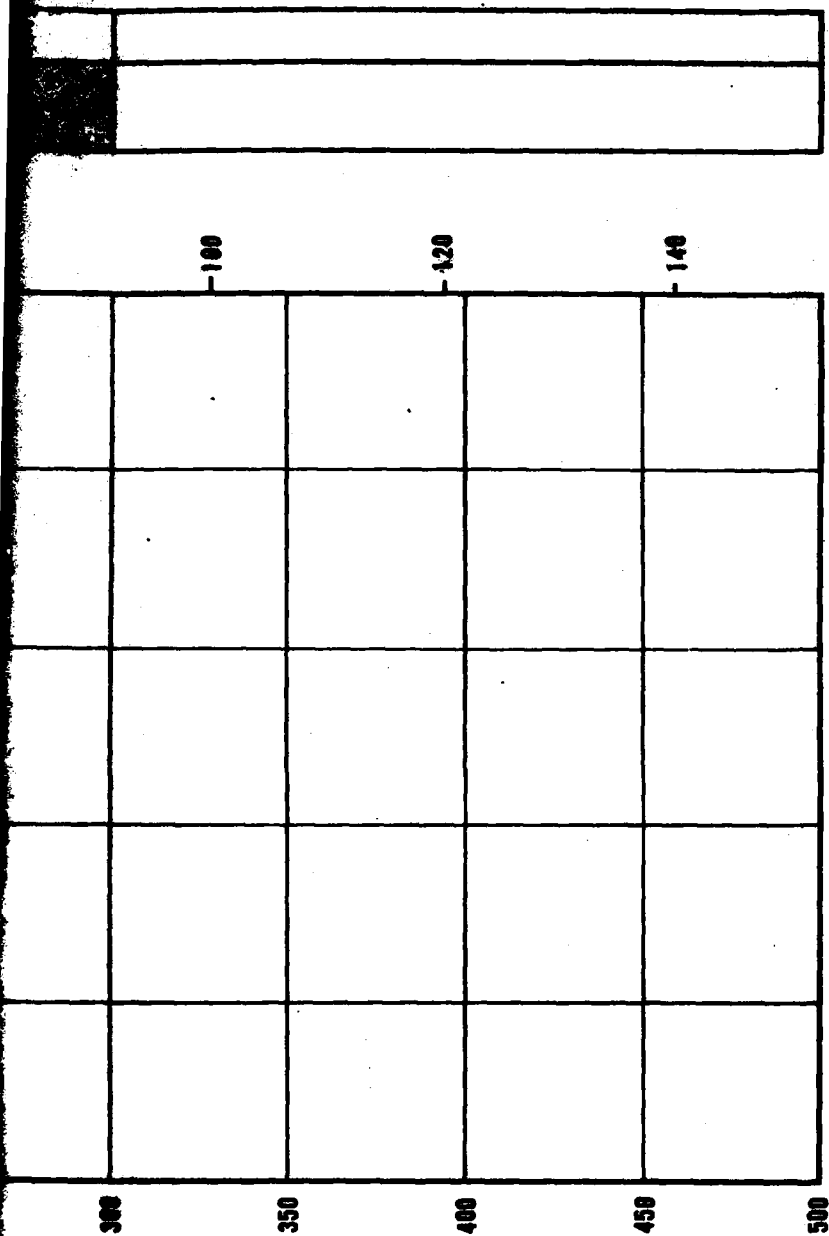


**DOWNHOLE VELOCITY DATA
LOG OF BOREING LD-6-0
LEONARDO DESERT, ARIZONA**

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - 34800

FIGURE
4-21



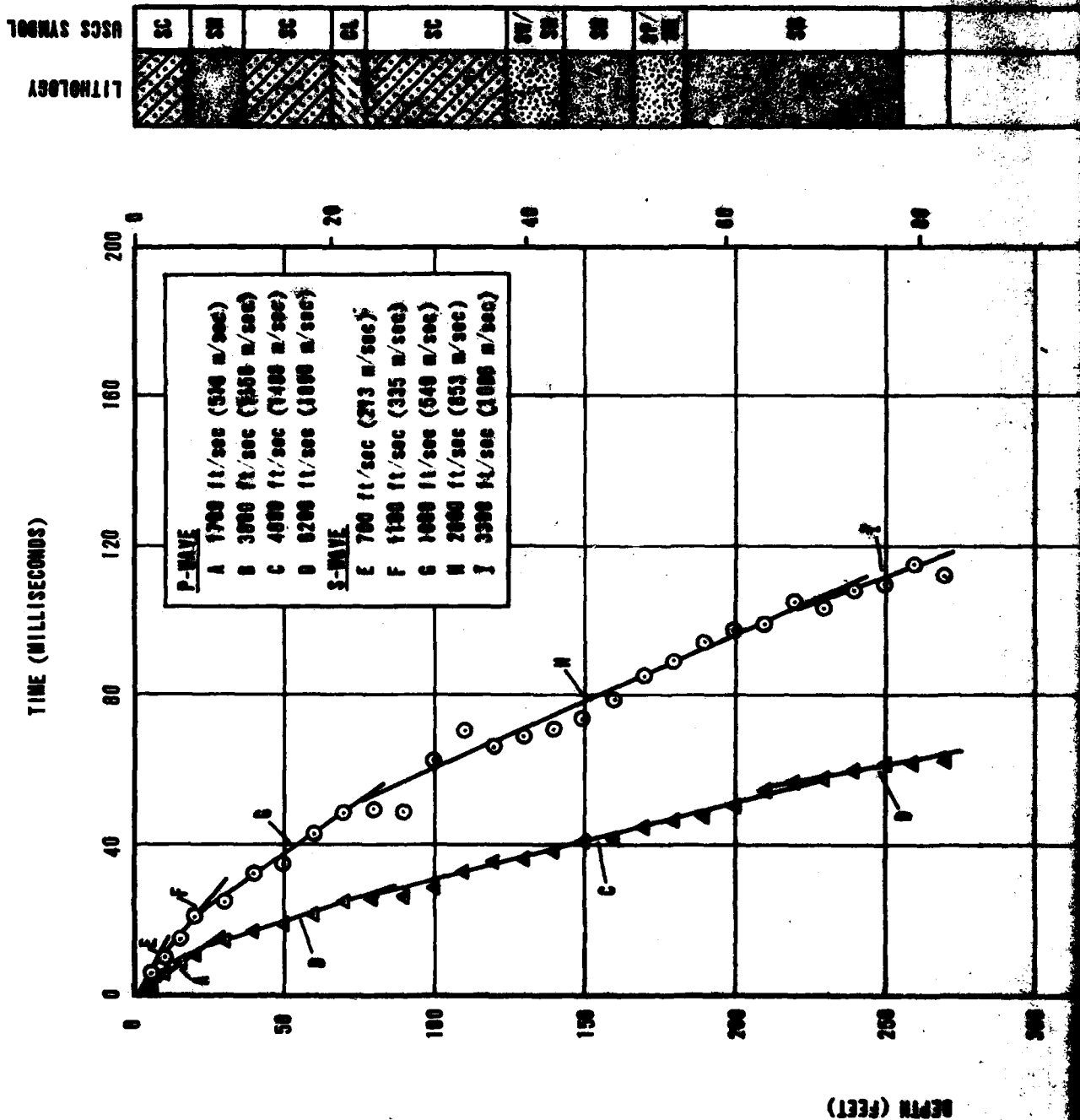


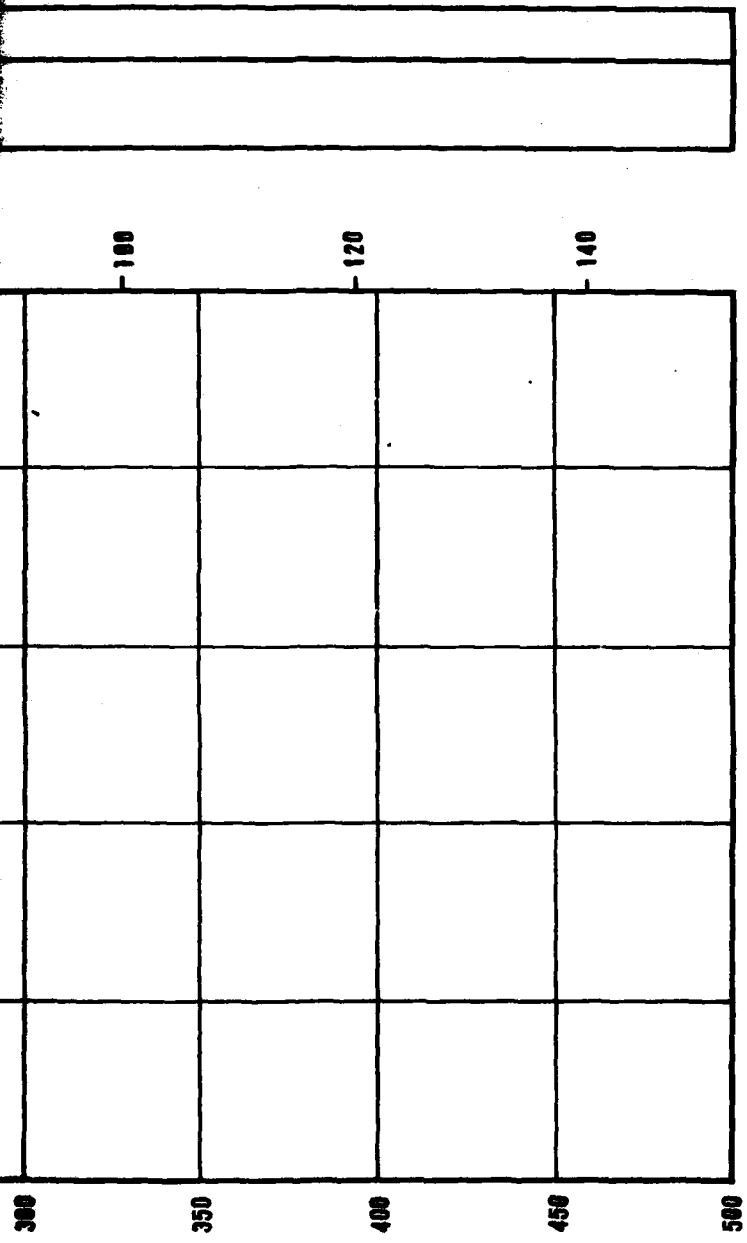
EXPLANATION

- ▲ COMPRESSIONAL WAVE DATA
- SHEAR WAVE DATA

DOWNHOLE VELOCITY DATA LOG OF BORING LD-6-1 TECHNICAL DESERT, ARIZONA	
ON SITE INVESTIGATION DEPARTMENT OF THE AIR FORCE - DODGE	DATE 1-68

ADDRESS





EXPLANATION

▲ COMPRESSIONAL WAVE DATA

○ SHEAR WAVE DATA

DOWNHOLE VELOCITY DATA
 LOG OF BORING 19-0-8
 LECTERVELLA BEACH, ARIZONA

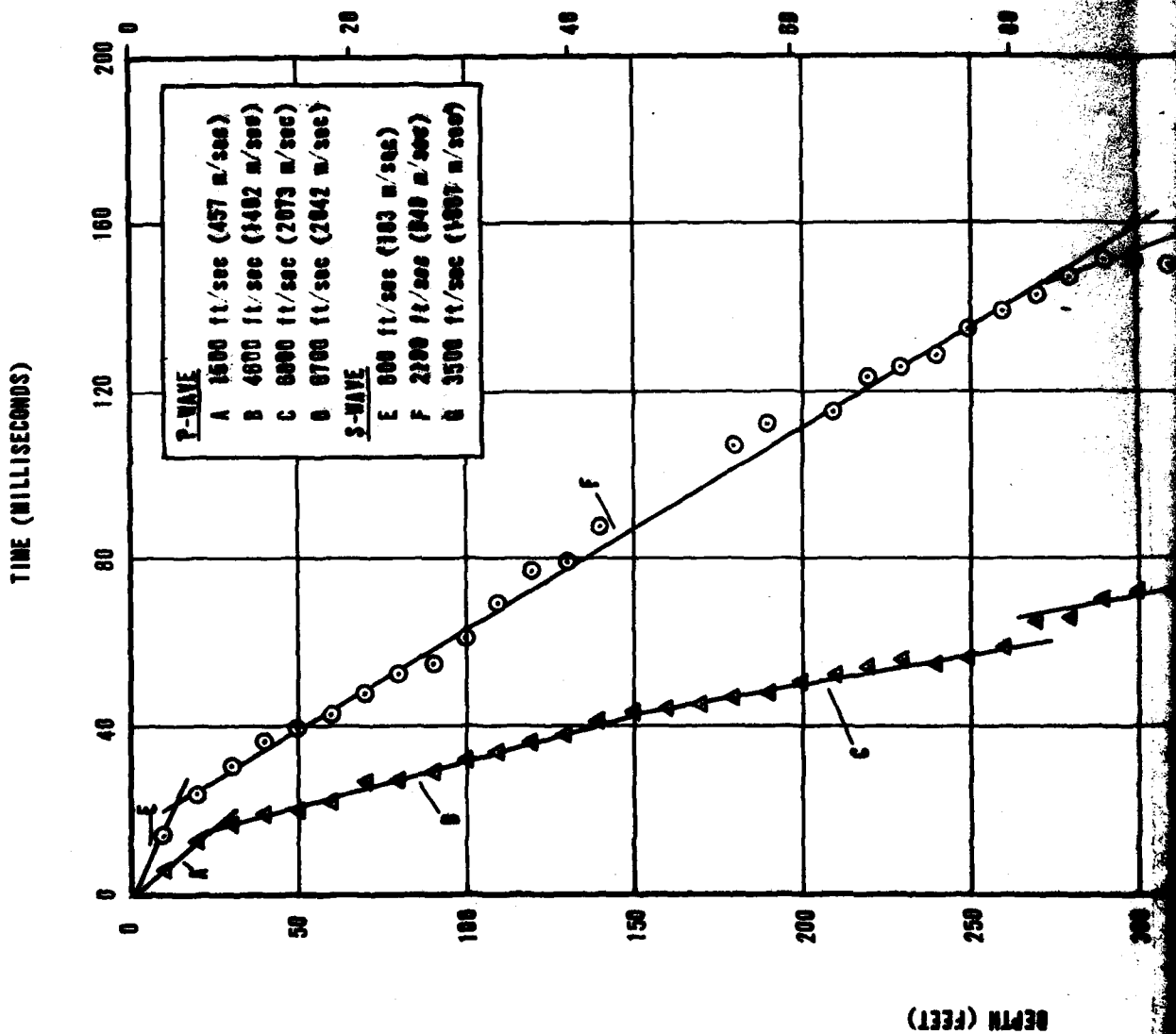
ON SITE INVESTIGATION
 DEPARTMENT OF THE AIR FORCE - SANDIA

CHECKED BY

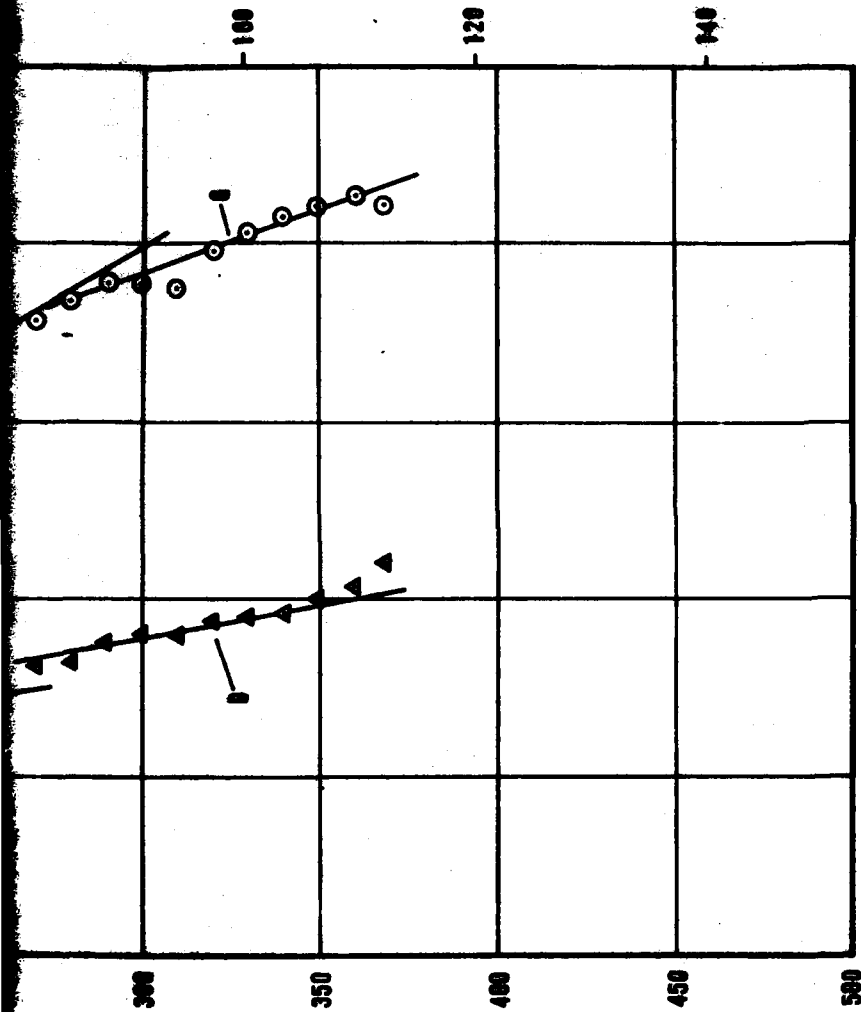
APPROVED BY

LITHOLOGY

USCS SYMBOL



SH	SH	



EXPLANATION

- ▲ COMPRESSIONAL WAVE DATA
- SHEAR WAVE DATA

DOWNHOLE VELOCITY DATA
LOG OF BORING 10-1-2
LEONARDVILLE MOUNTAIN, MISSISSIPPI

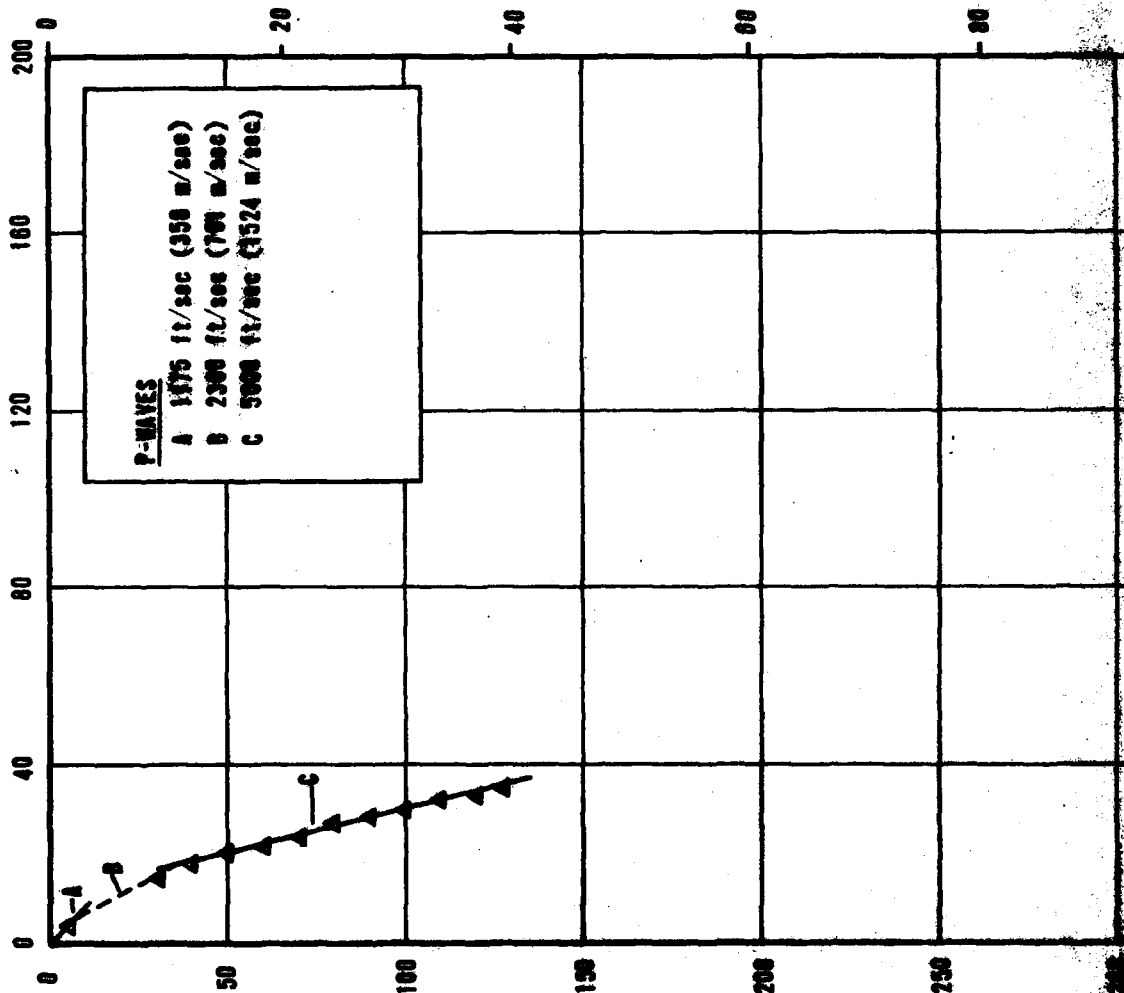
ON SITE INVESTIGATION
DEPARTMENT OF THE ARMY - CORPS OF ENGINEERS

FIGURE 1

CHECKED BY

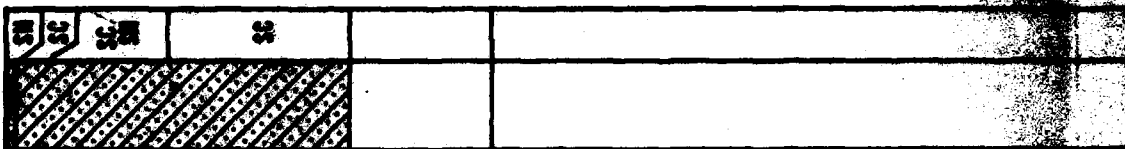
APPROVED BY

TIME (MILLISECONDS)

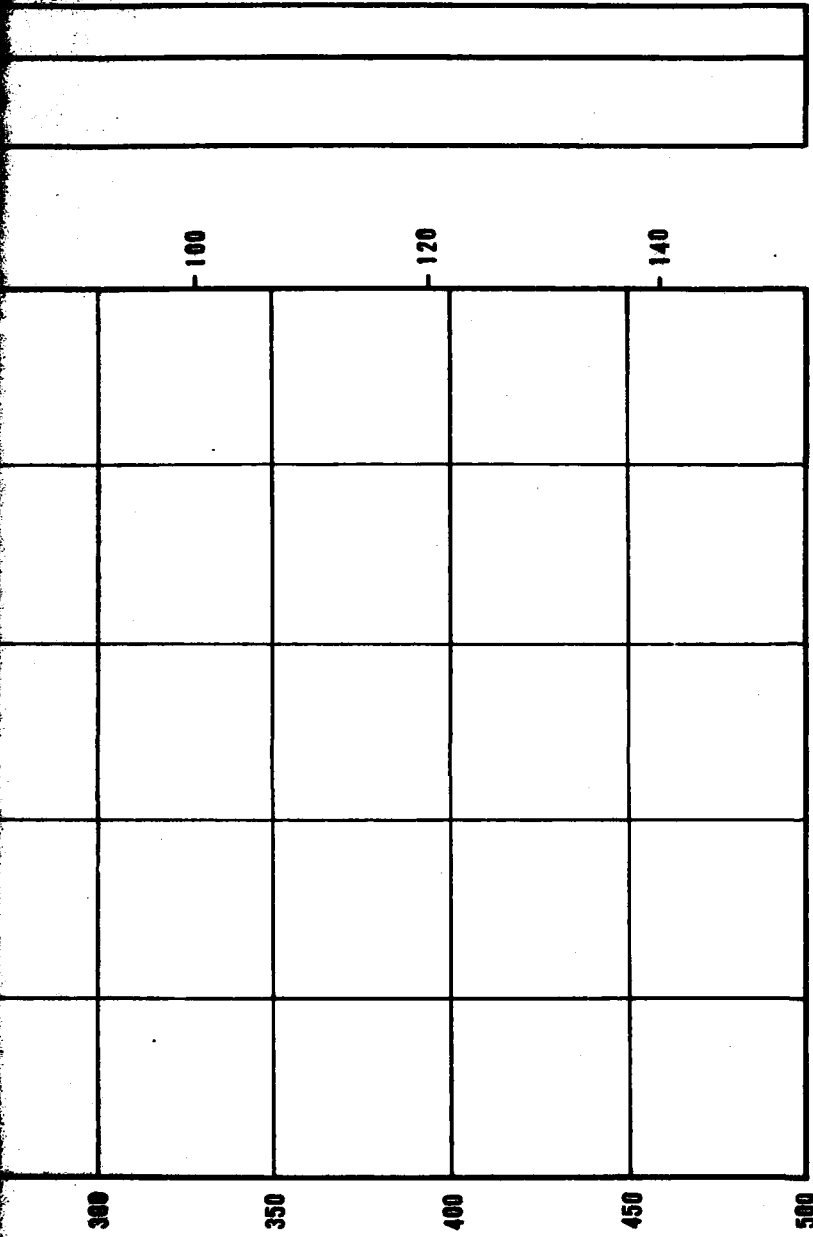


DEPTH (FEET)

LITHOLOGY



USCS SYMBOL



EXPLANATION

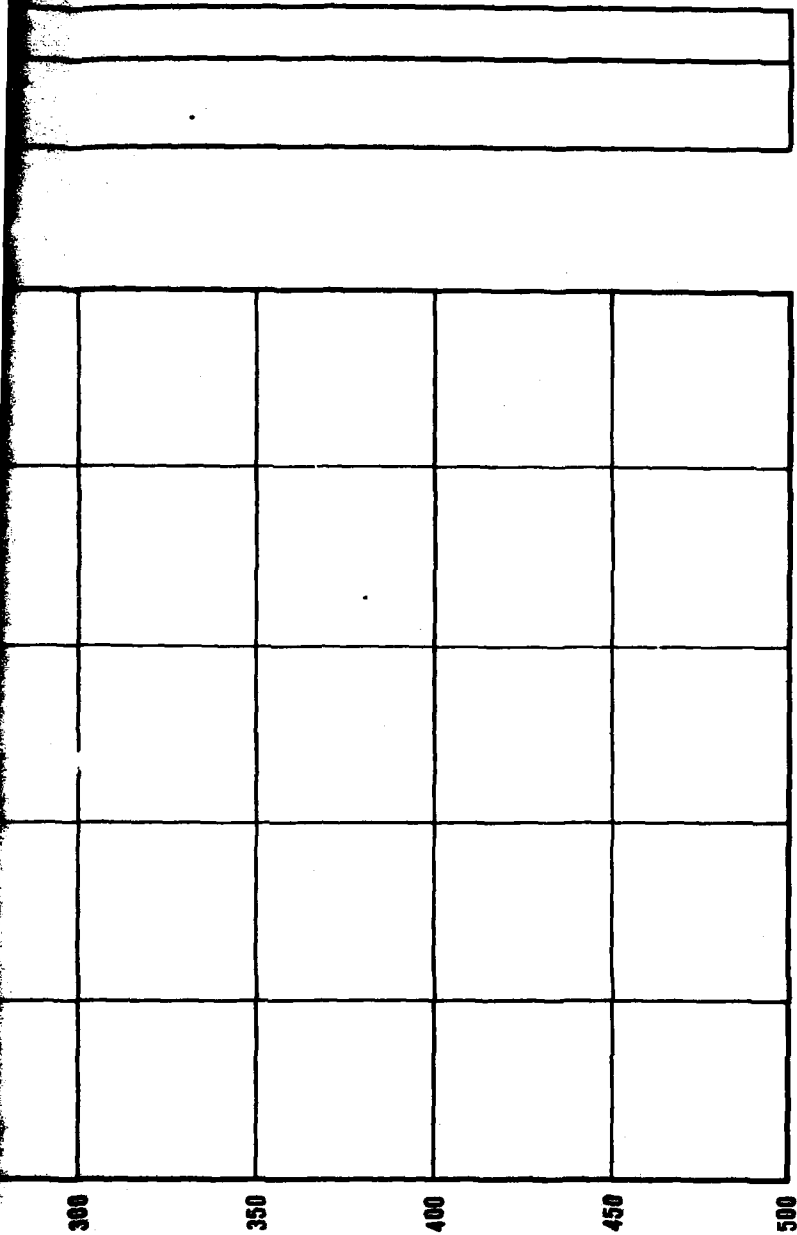
- ▲ COMPRESSIONAL WAVE DATA
- SHEAR WAVE DATA - UNABLE TO IDENTIFY S-WAVES ON THESE RECORDS

DOWNHOLE VELOCITY DATA LOG OF BORING LG-2-1 LECHUWILLA DESERT, ARIZONA	
NR SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANDO	FIGURE 2-20

2

LIHOLONG





EXPLANATION

▲ COMPRESSIONAL WAVE DATA

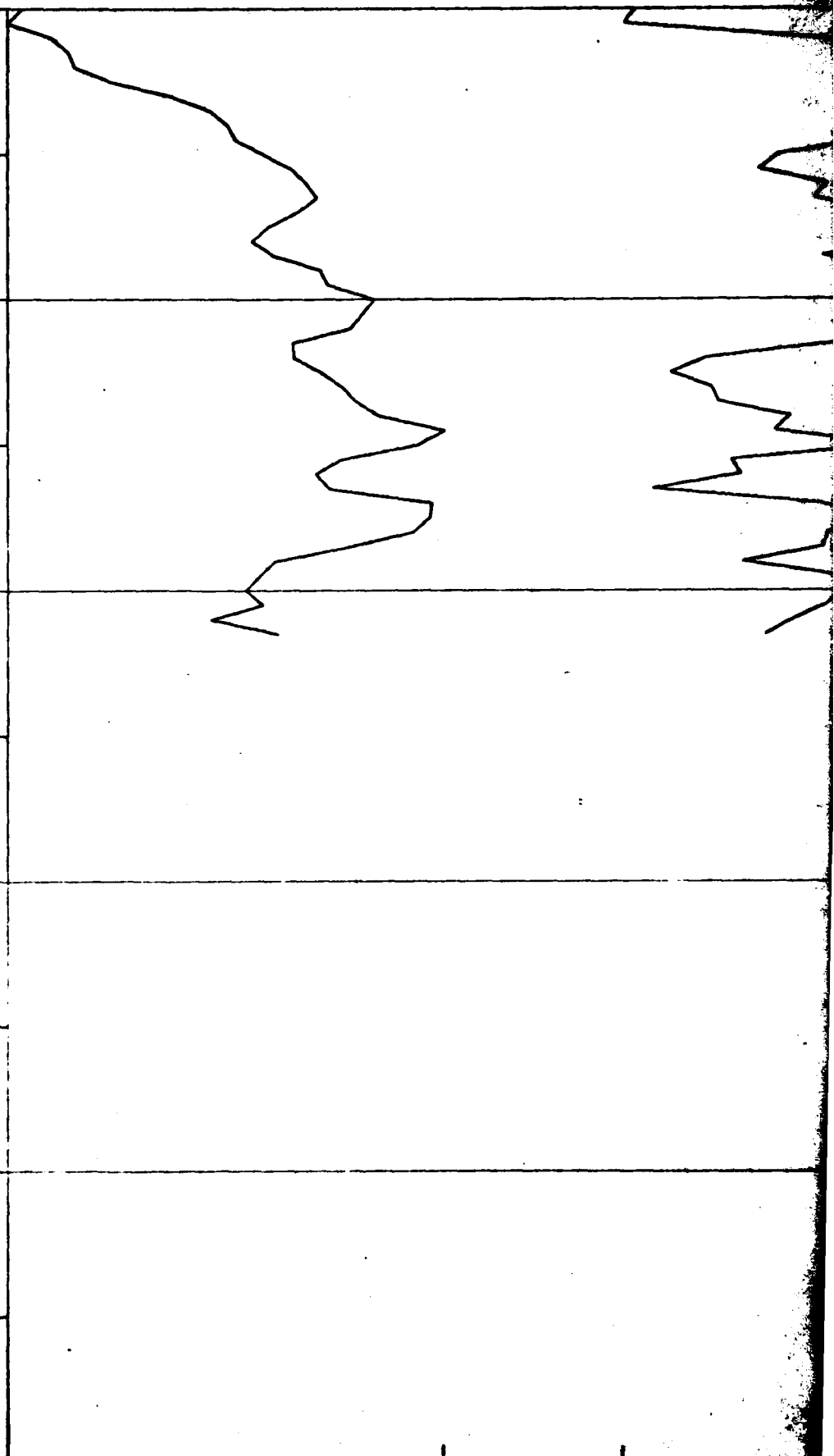
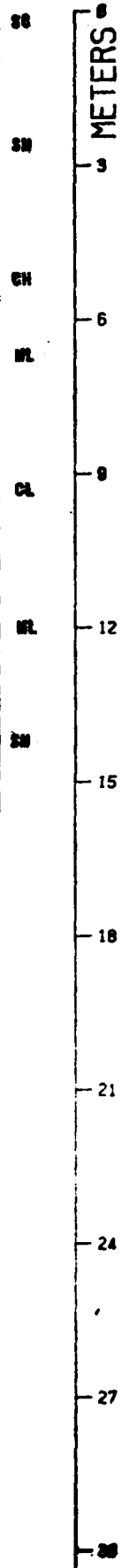
○ SHEAR WAVE DATA

DOWNHOLE VELOCITY DATA
LOG OF BORING LG-4-17
LECHUWILLA DESERT, ARIZONA

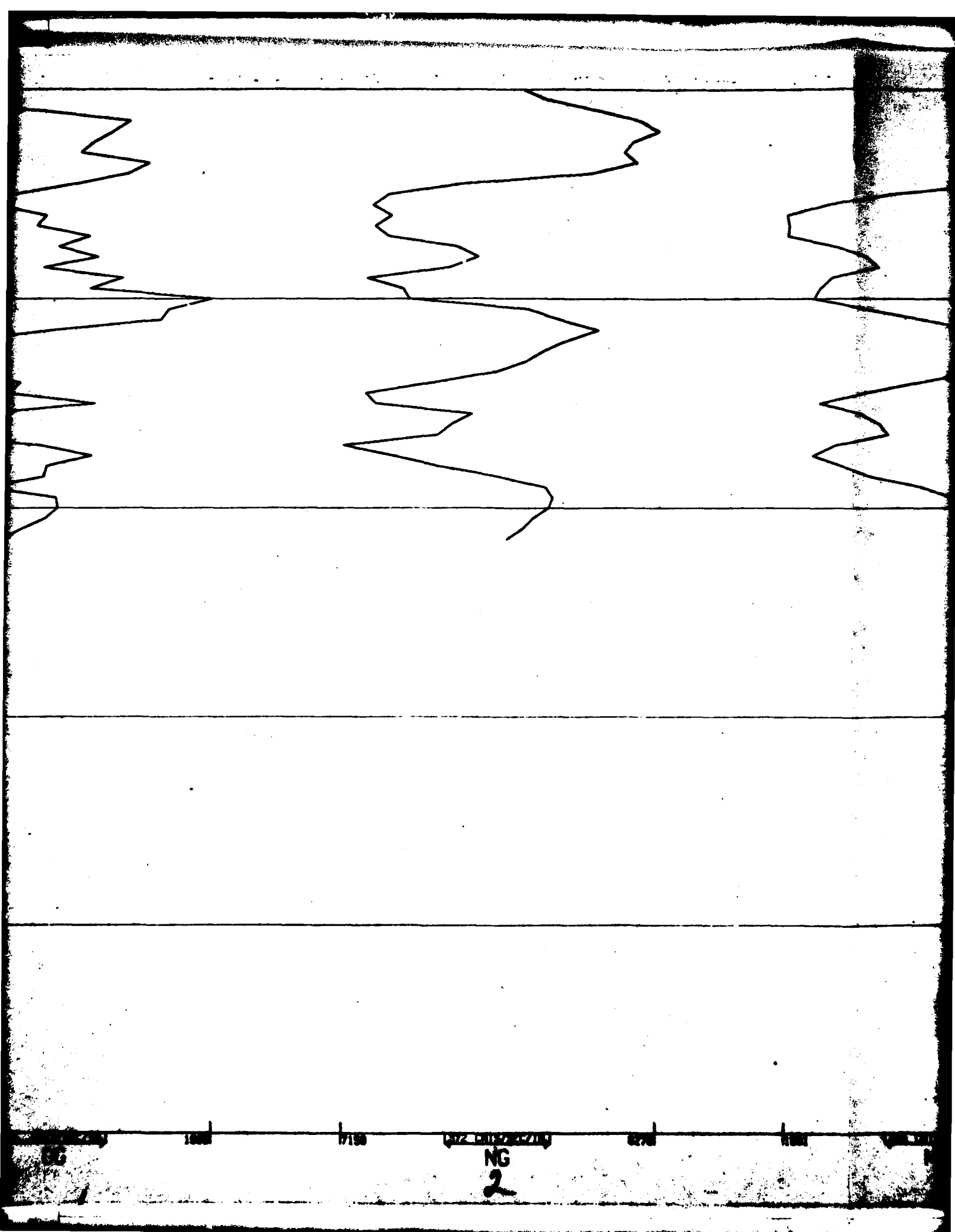
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SANDO

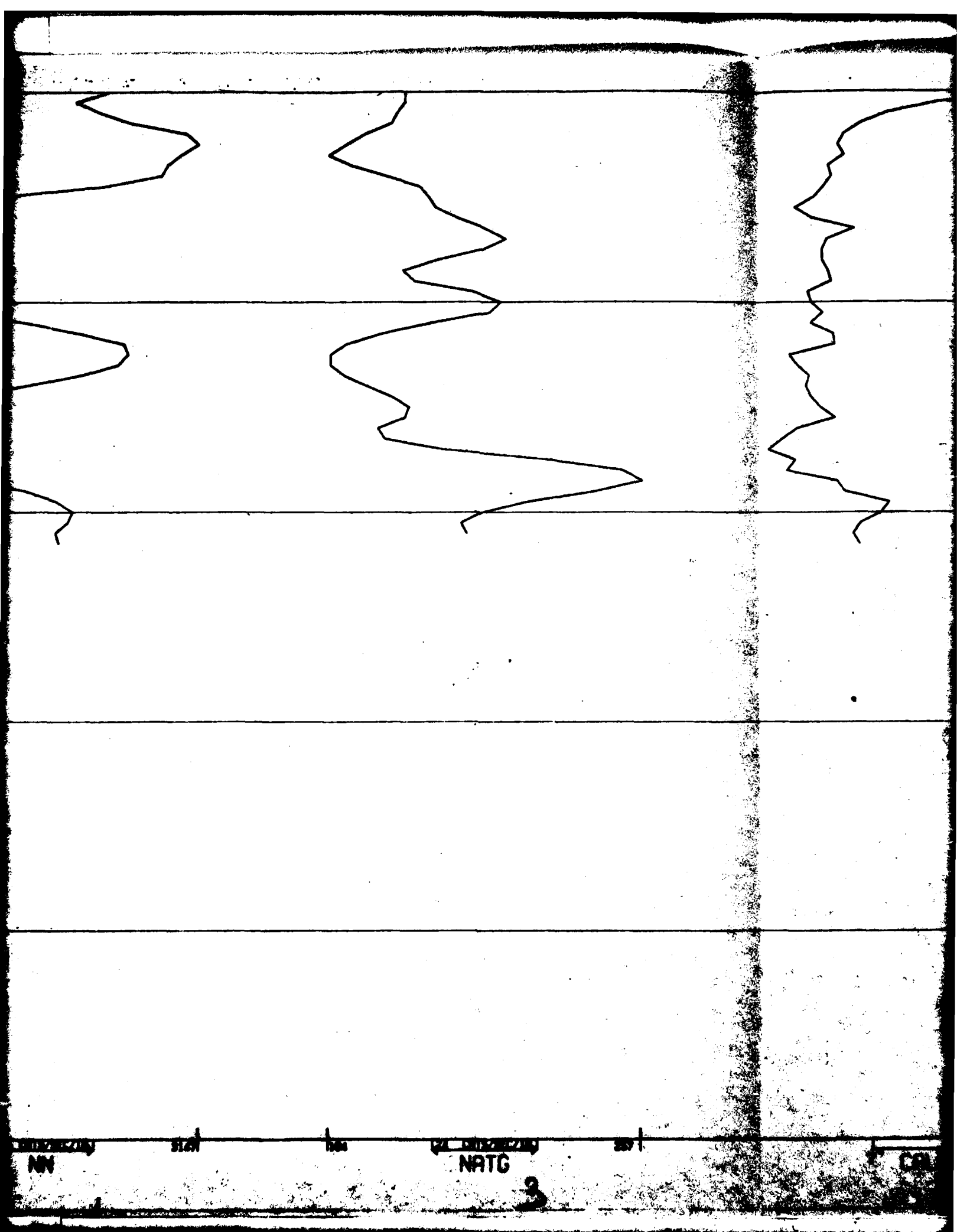
FIGURE

1-40



GM





NN

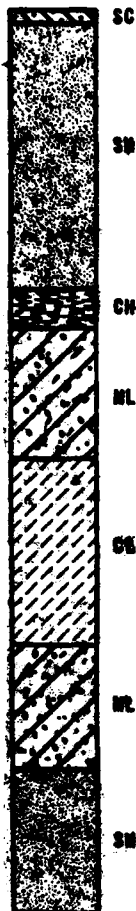
NATG

3

FEET
METERS

3
5
9
12
15
18
21
24
27
30

20
40
60
80
100



WASHINGTON STATE UNIVERSITY

COLLEGE OF ENGINEERING

GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

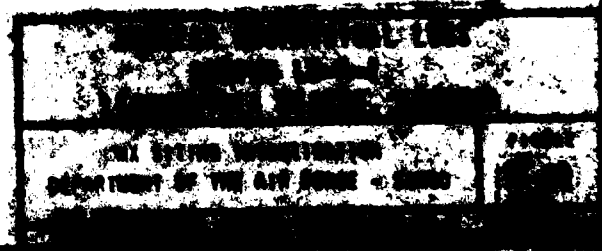
PROJECT NAME AIR FORCE
BORING NO. LD-A-1
ELEVATION 430' (431m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 4/26/77
TOTAL DEPTH LOGGED 45' (94m)
DEPTH TO WATER LEVEL
REMARKS

EXPLANATION

LOG TITLES

NATG - NATURAL GAMMA
GG - GAMMA
NN - NEUTRON
NG - NEUTRON GAMMA
FT - FLUID TEMPERATURE
FR - FLUID RESISTIVITY
CALP - CALIPER
SP - SPONTANEOUS POTENTIAL
WRES - RESISTIVITY
FMTR - FLOW METER
GM - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
POROSITY (NN-LOG) INCREASES ←
WATER LEVEL -----



PLP 7 1/4"



METERS

0

6

9

12

15

18

21

24

27

30

FEET

0

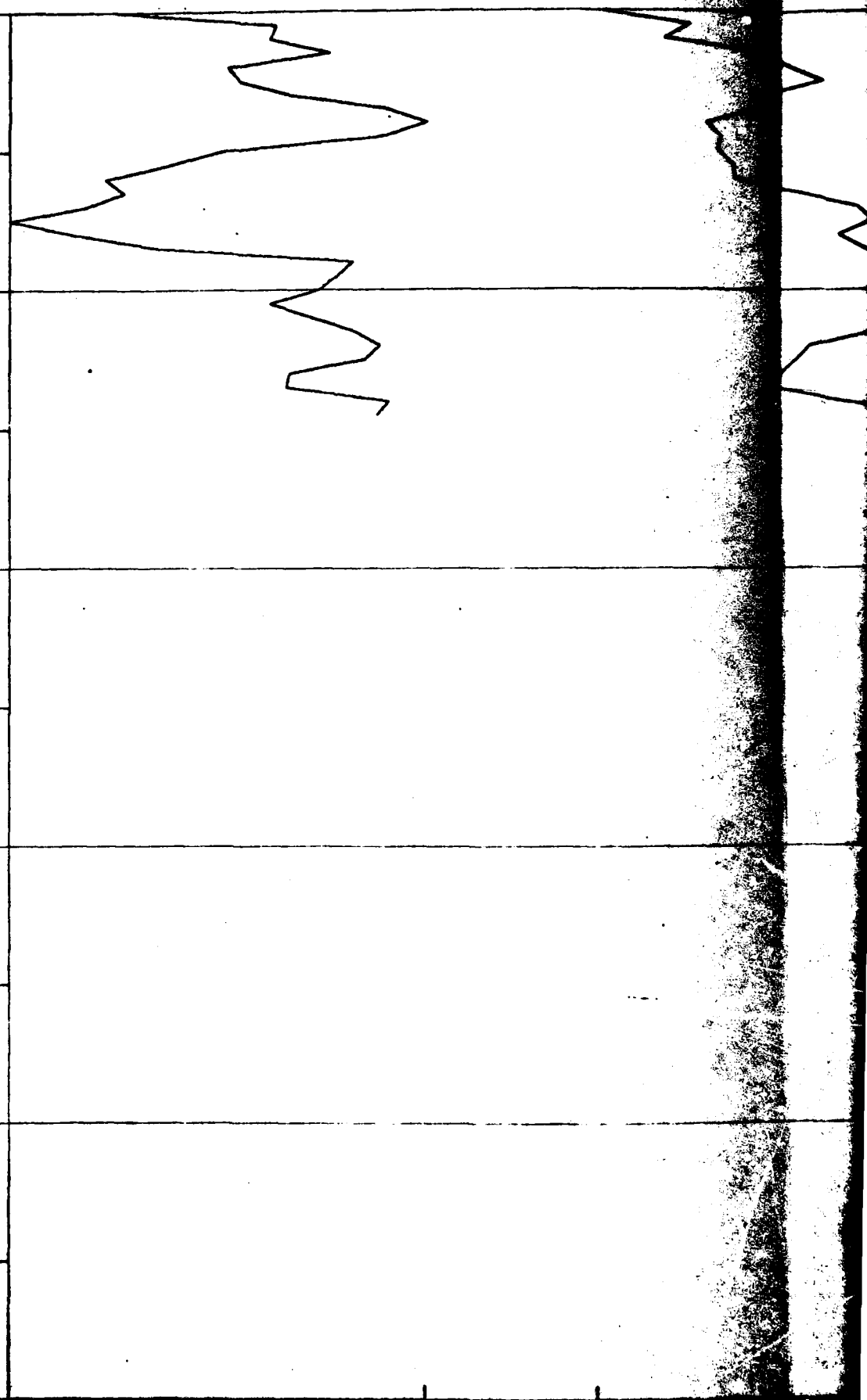
20

40

60

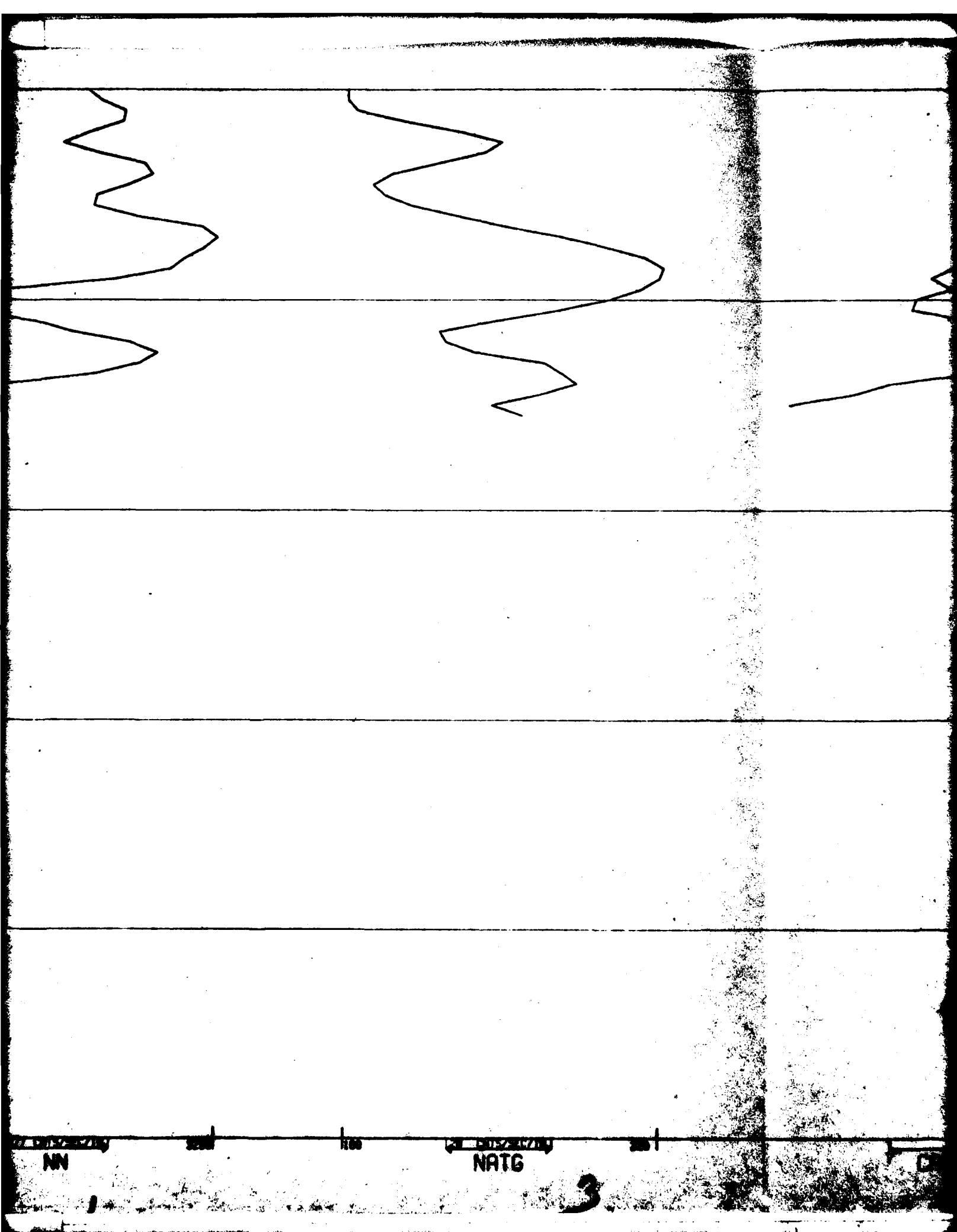
80

100



GM

SG



NN

NATG

3

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COLLEGE OF ENGINEERING

GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
BORING NO. LD-A-2
ELEVATION 980' (299m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/6/77
TOTAL DEPTH LOGGED . . 31' (9m)
DEPTH TO WATER LEVEL . —
REMARKS —

EXPLANATION

LOG TITLES

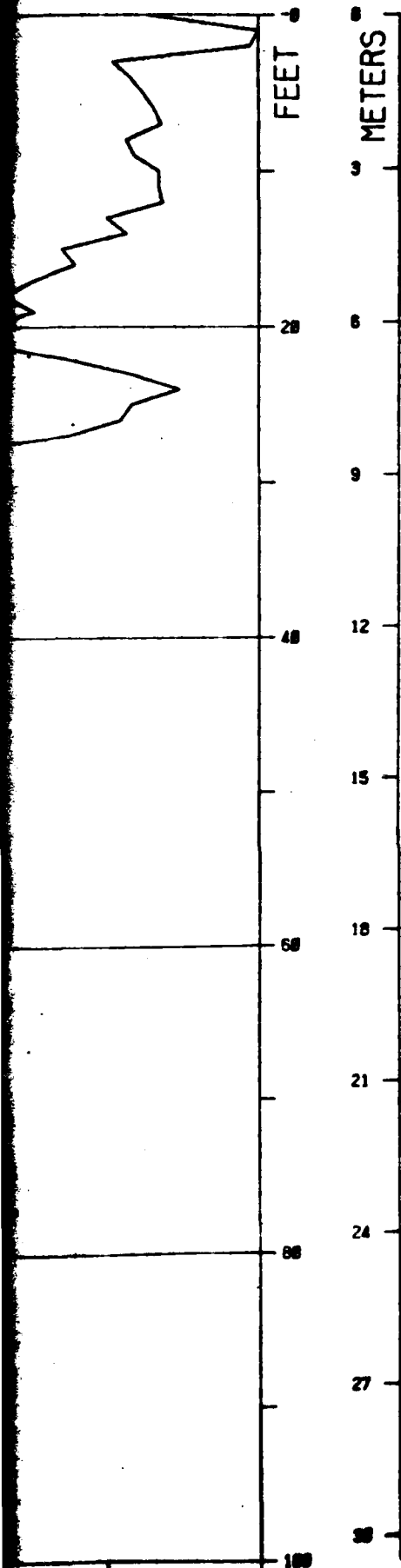
NATG	- -	NATURAL GAMMA
GG	- -	GAMMA GAMMA
NN	- -	NEUTRON NEUTRON
NG	- -	NEUTRON GAMMA
FT	- -	FLUID TEMPERATURE
FR	- -	FLUID RESISTIVITY
CLP	- -	CALIPER
SP	- -	SPONTANEOUS POTENTIAL
RES	- -	RESISTIVITY
FM	- -	FLOW METER
GM	- -	DELTA GAMMA

DENSITY LOG-LOG INCREASES →

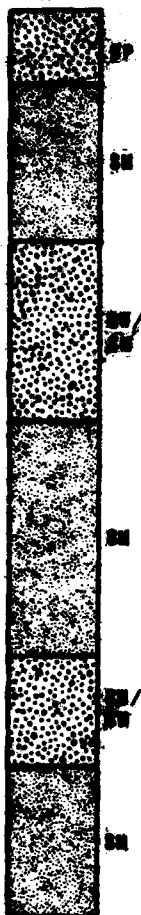
POROSITY (NN-LOG) INCREASES ←

WATER LEVEL -----

WELL LOG PROCESSING SYSTEM
GEOHYDROLOGY SECTION
COLLEGE OF ENGINEERING
WASHINGTON STATE UNIVERSITY
PULLMAN, WASHINGTON 99164-5030



CLP 7 3/16"



METERS

0

3

6

9

12

15

18

21

24

27

30

FEET

0

10

20

30

40

50

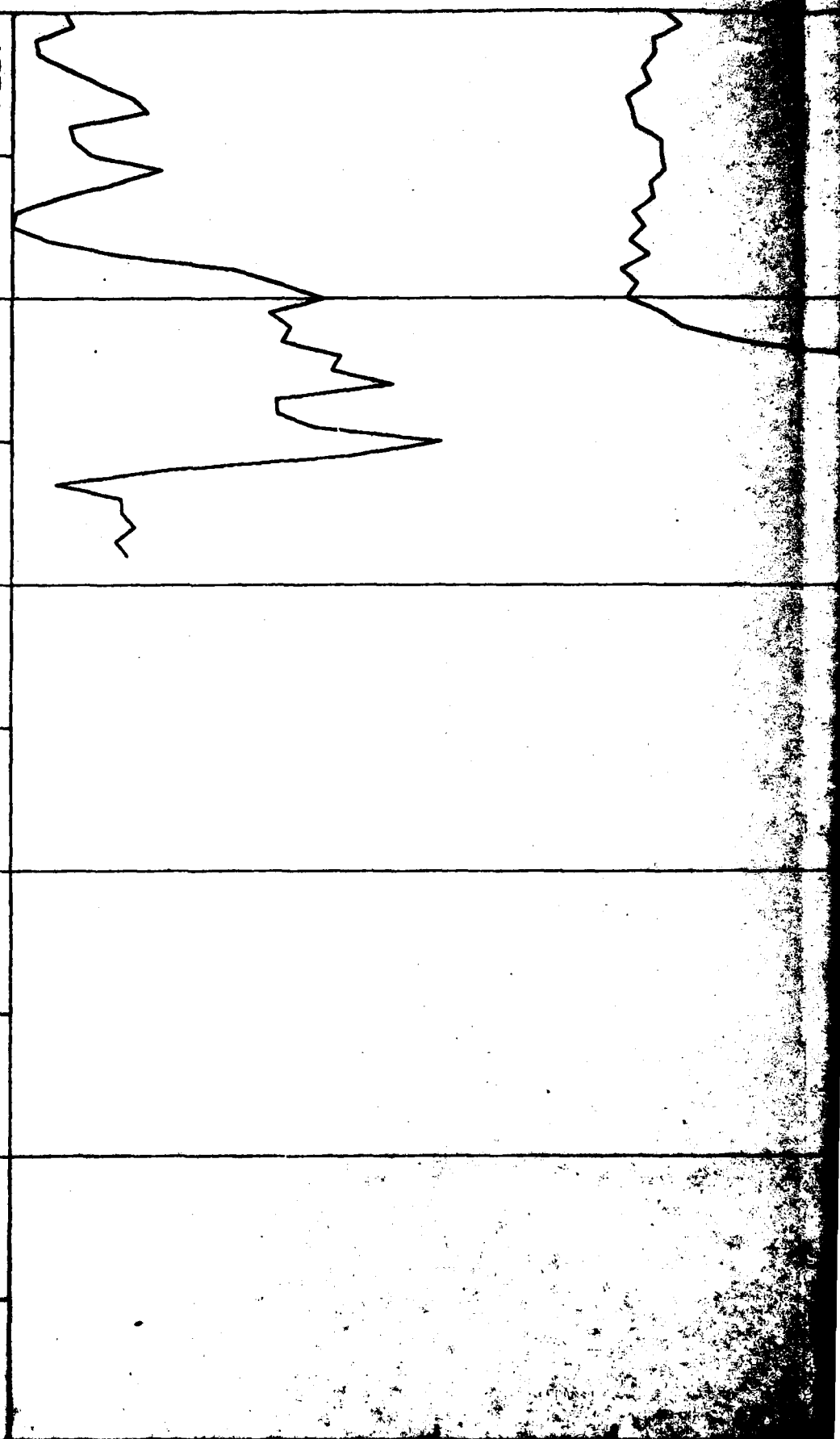
60

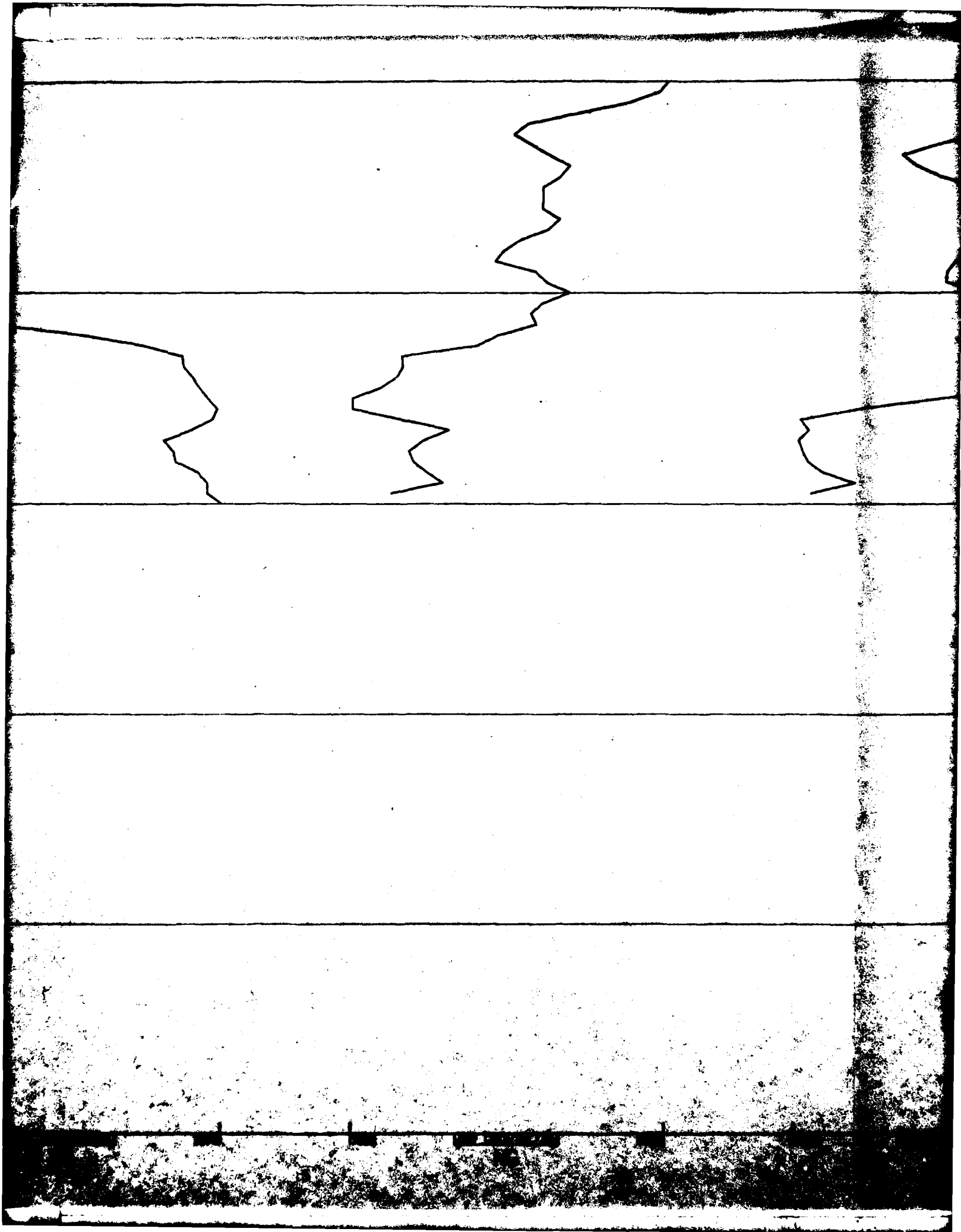
70

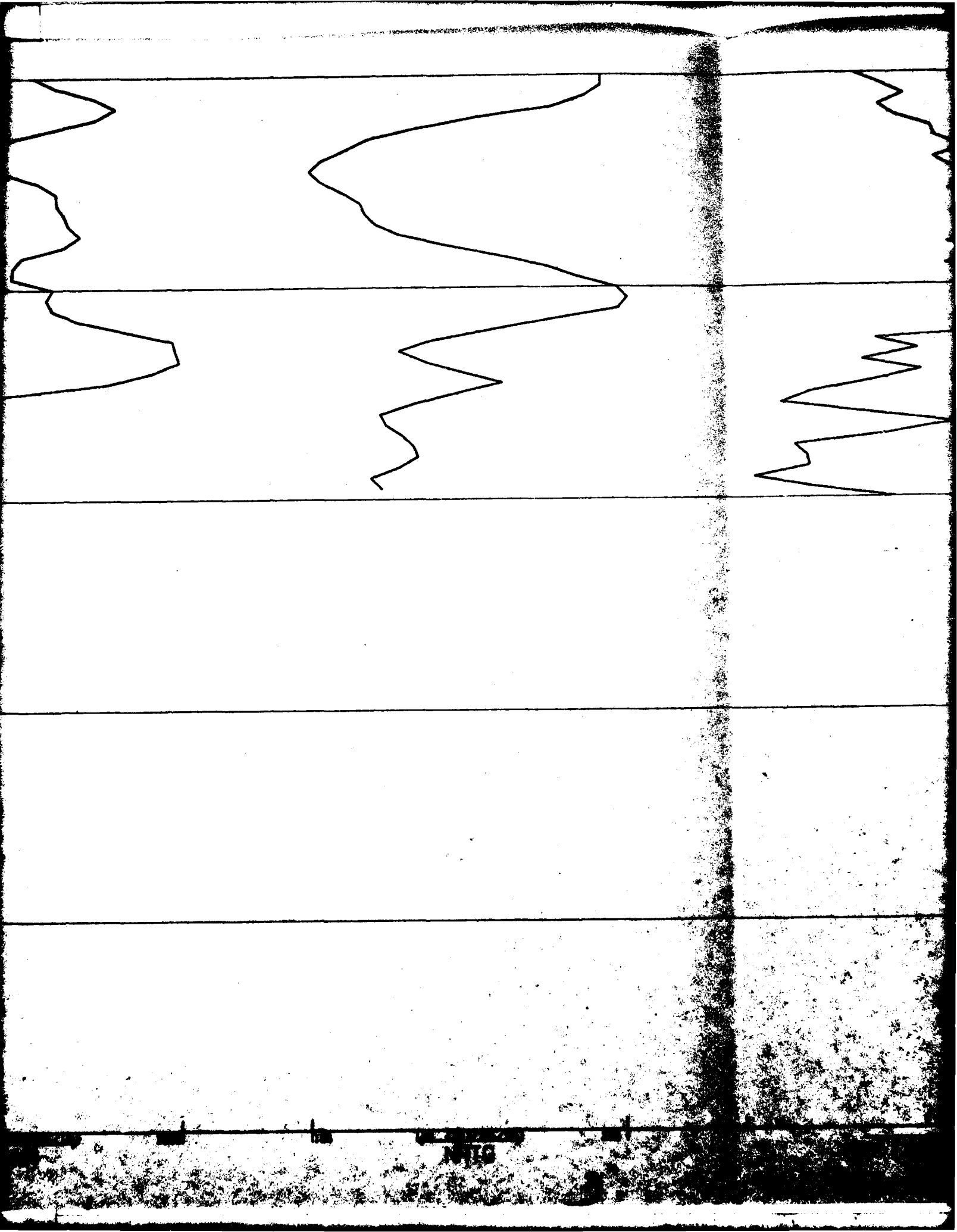
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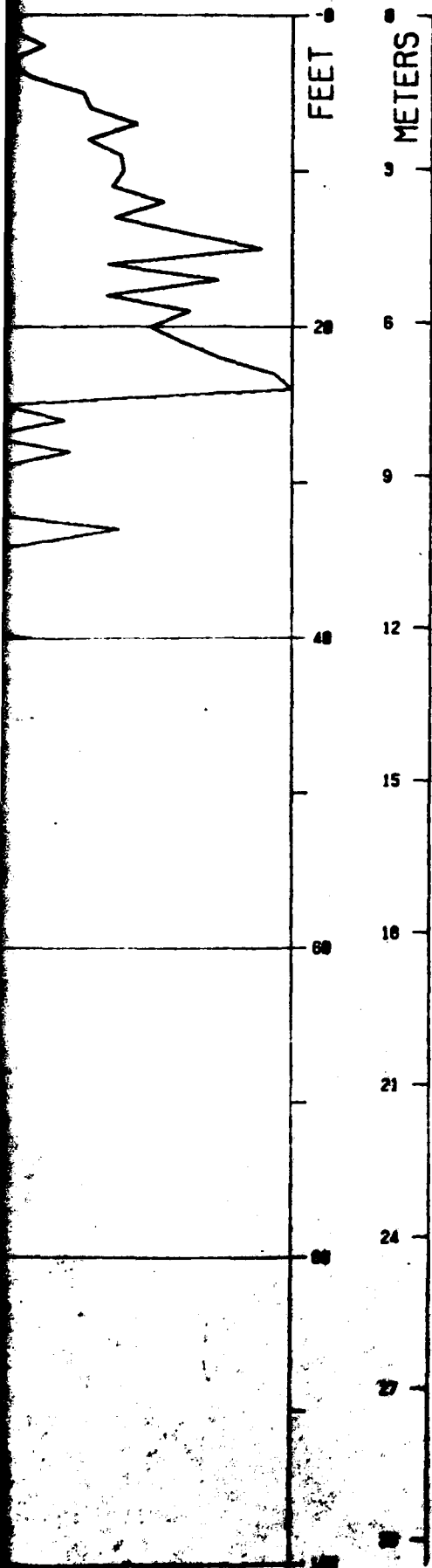
90

100









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GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
BORING NO. LD-A 9
ELEVATION 600' (183m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/26/77
TOTAL DEPTH LOGGED . . 41' (12m)
DEPTH TO WATER LEVEL. —
REMARKS —

EXPLANATION

LOG TITLES

NGG - - - NATURAL GAMMA
GG - - - GAMMA GAMMA
NN - - - NEUTRON NEUTRON
NG - - - NEUTRON GAMMA
FT - - - FLUID TEMPERATURE
FR - - - FLUID RESISTIVITY
CALP - - - CALIPER
SP - - - SPONTANEOUS POTENTIAL
RES - - - RESISTIVITY
FMR - - - FLOW METER
GM - - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
POROSITY (NN-LOG) INCREASES ←
WATER LEVEL -----



METERS

FEET

6

20

9

48

15

18

60

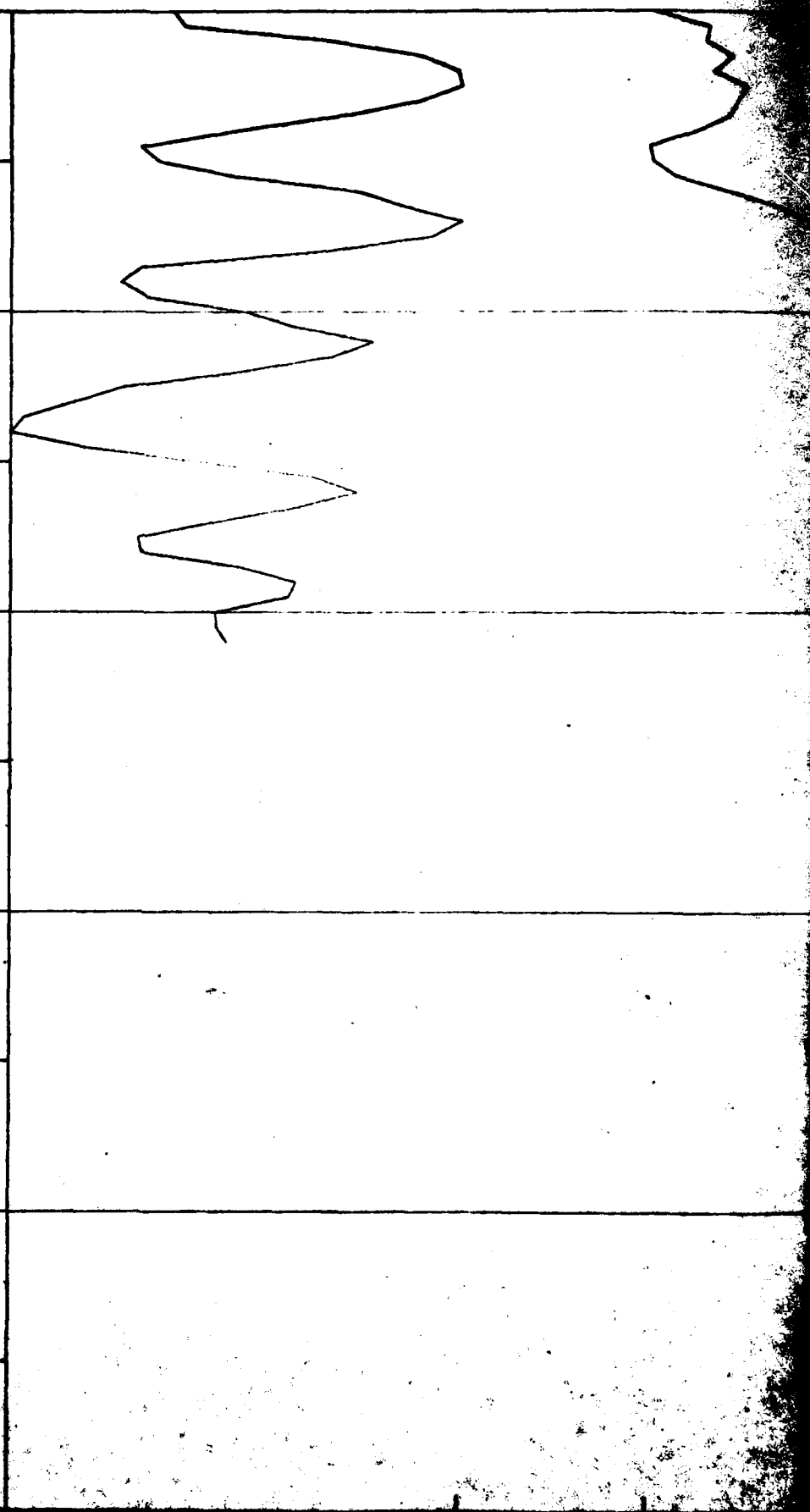
21

24

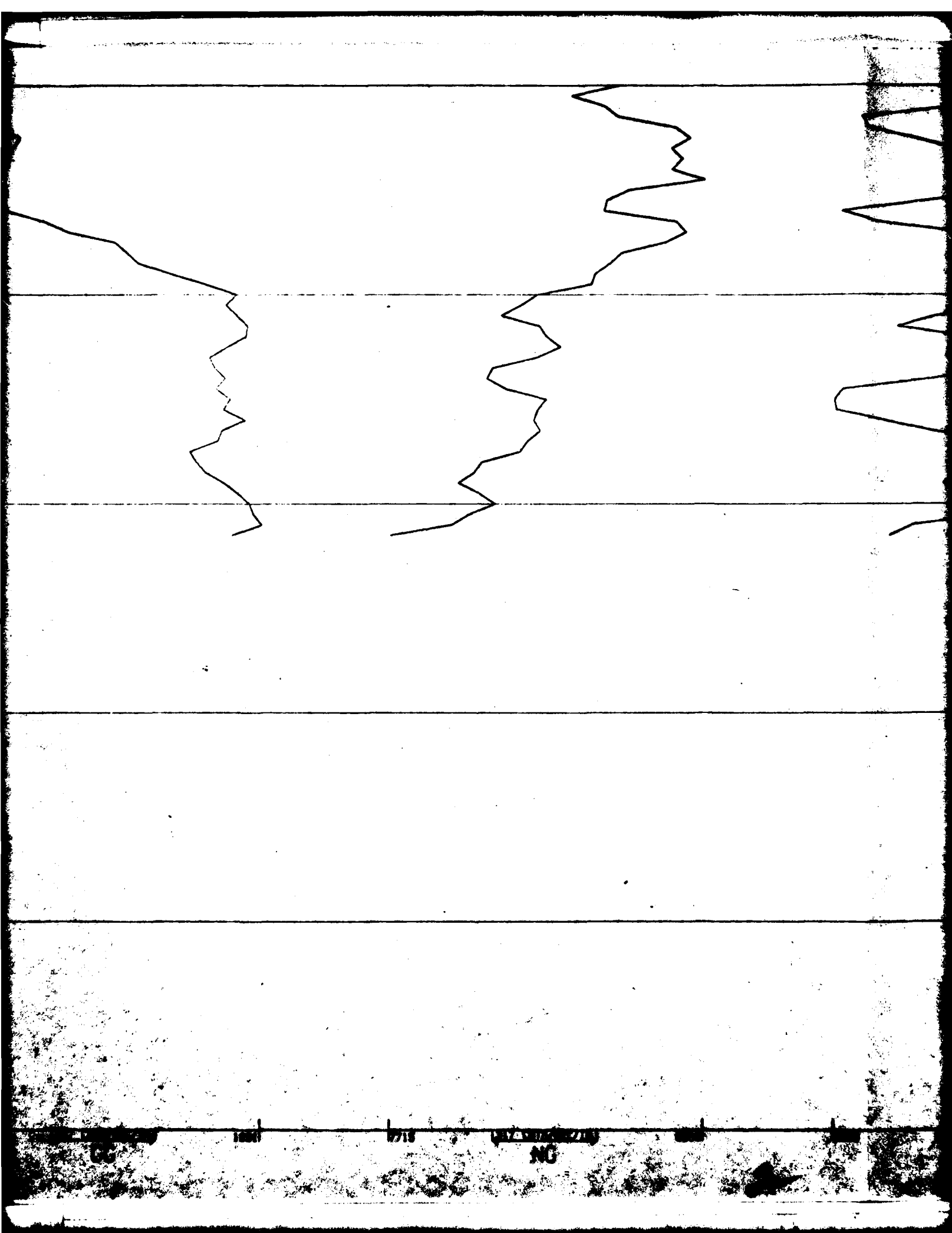
66

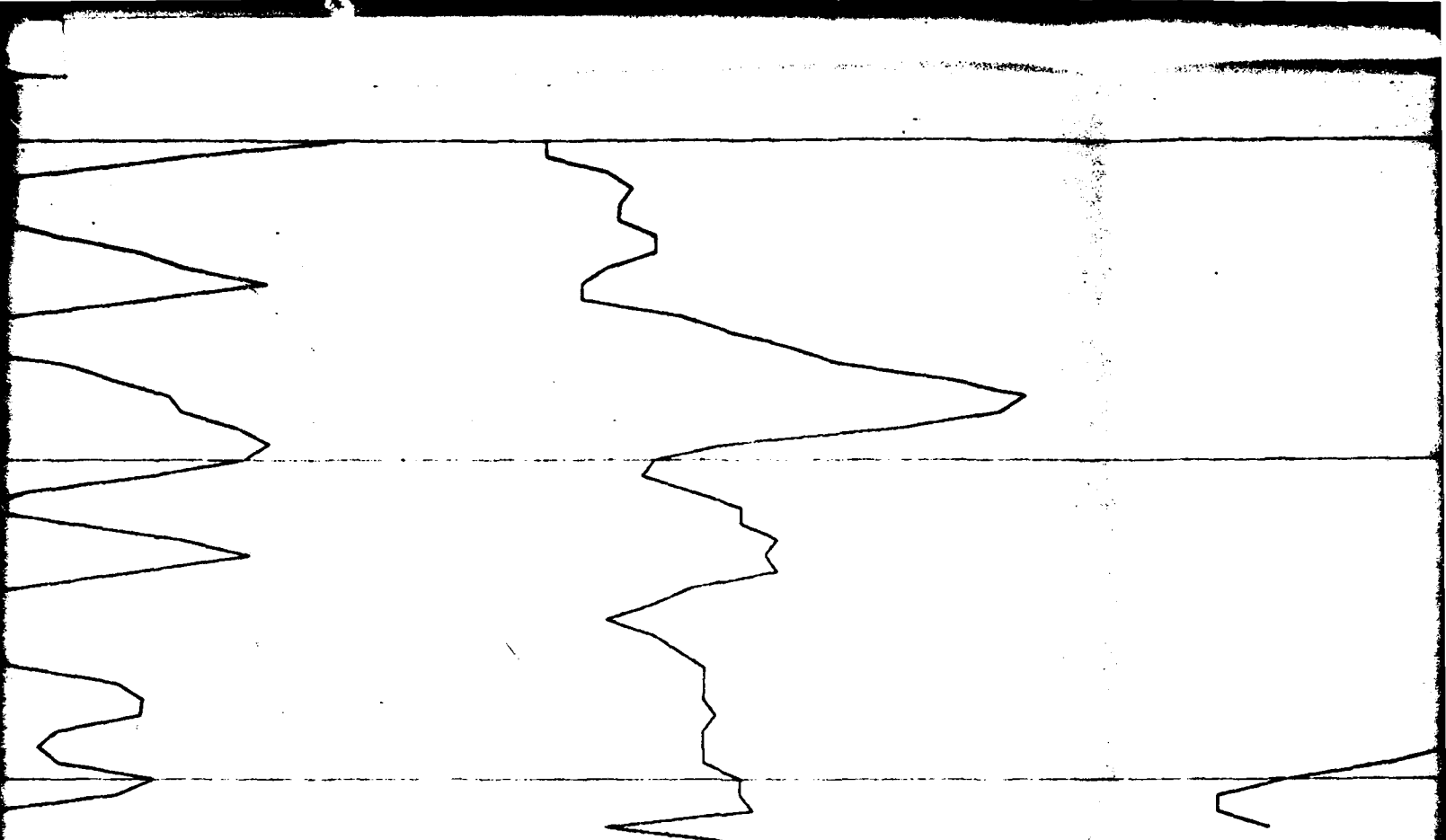
27

30



61





1000 2000 3000 4000 5000

1000 2000 3000 4000 5000

1000

NN

NATG

9

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GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
 BOREING NO. LD-4-10
 ELEVATION 688' (210m)
 STATE ARIZONA
 COUNTY YUMA
 STUDY AREA LECHUGUILLA DES.
 DATE LOGGED 6/05/77
 TOTAL DEPTH LOGGED 45' (13.7m)
 DEPTH TO WATER LEVEL —
 REMARKS —

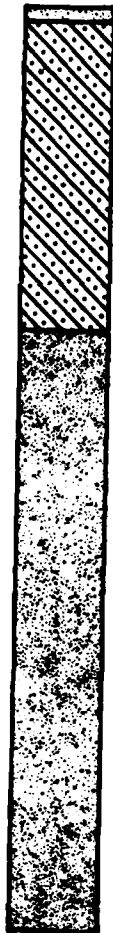
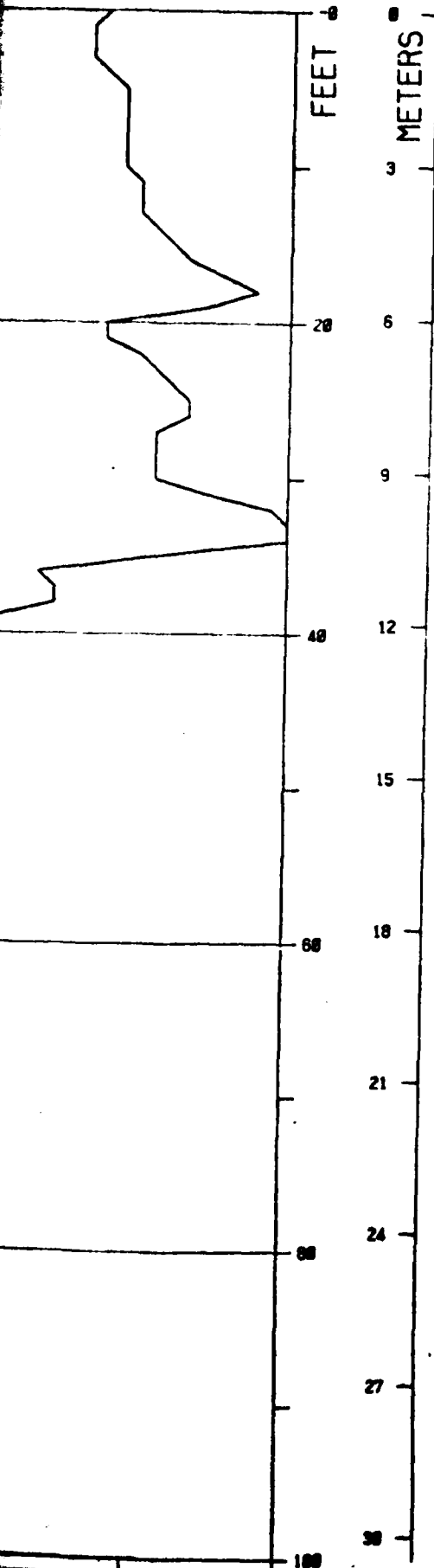
CALIPER IS HAND DIGITIZED

EXPLANATION

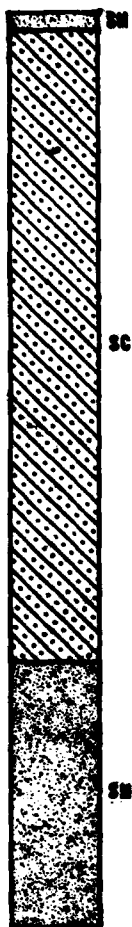
LOG TITLES

NATG - - - NATURAL GAMMA
 GG - - - GAMMA GAMMA
 NN - - - NEUTRON NEUTRON
 NG - - - NEUTRON GAMMA
 FT - - - FLUID TEMPERATURE
 FR - - - FLUID RESISTIVITY
 CALP - - - CALIPER
 SP - - - SPONTANEOUS POTENTIAL
 WRES - - - RESISTIVITY
 FMTR - - - FLOW METER
 GH - - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
 POROSITY (NN-LOG) INCREASES ←
 WATER LEVEL



CALP 73/16



METERS

3

6

9

12

15

18

21

24

27

30

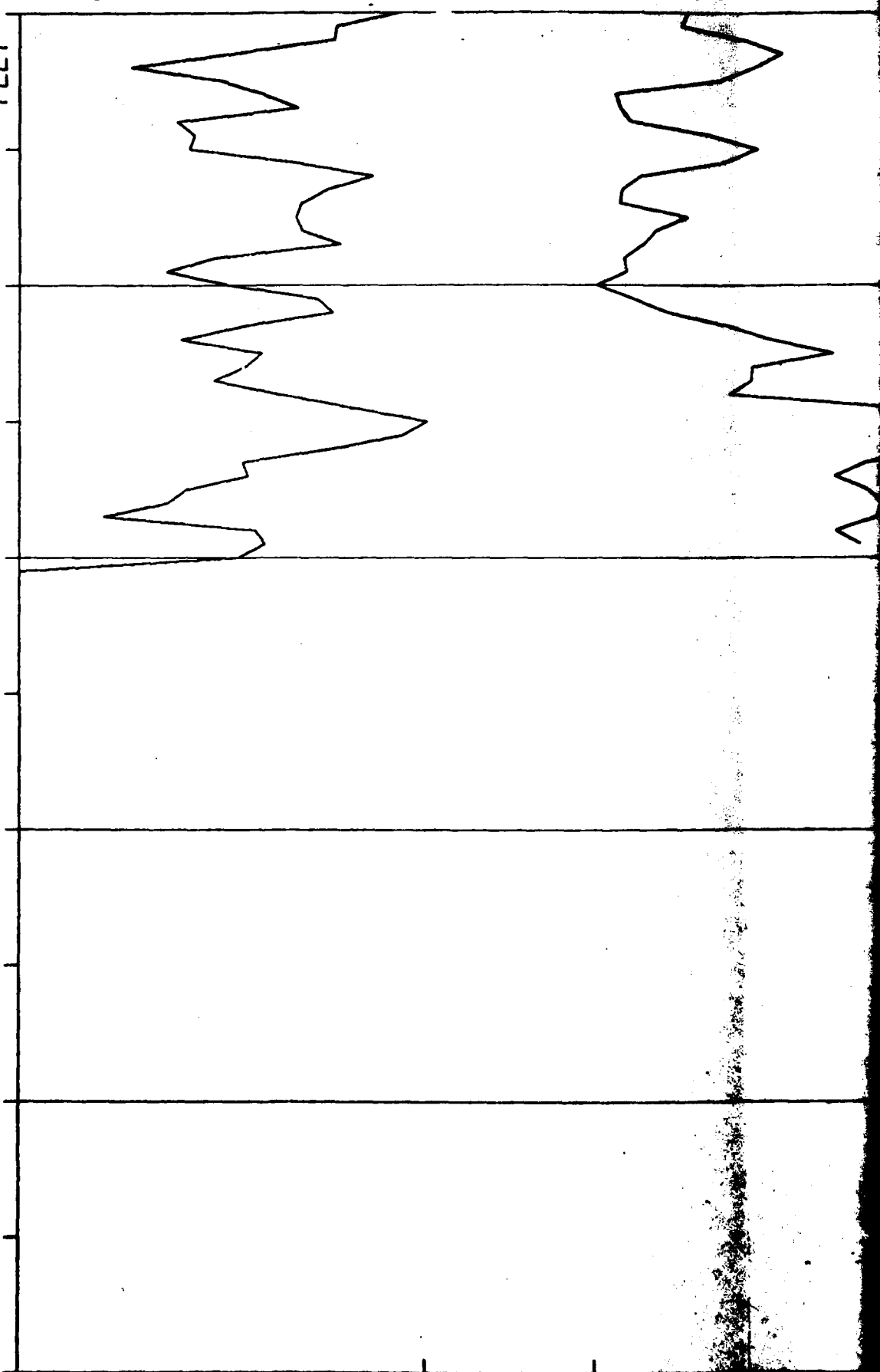
FEET

28

48

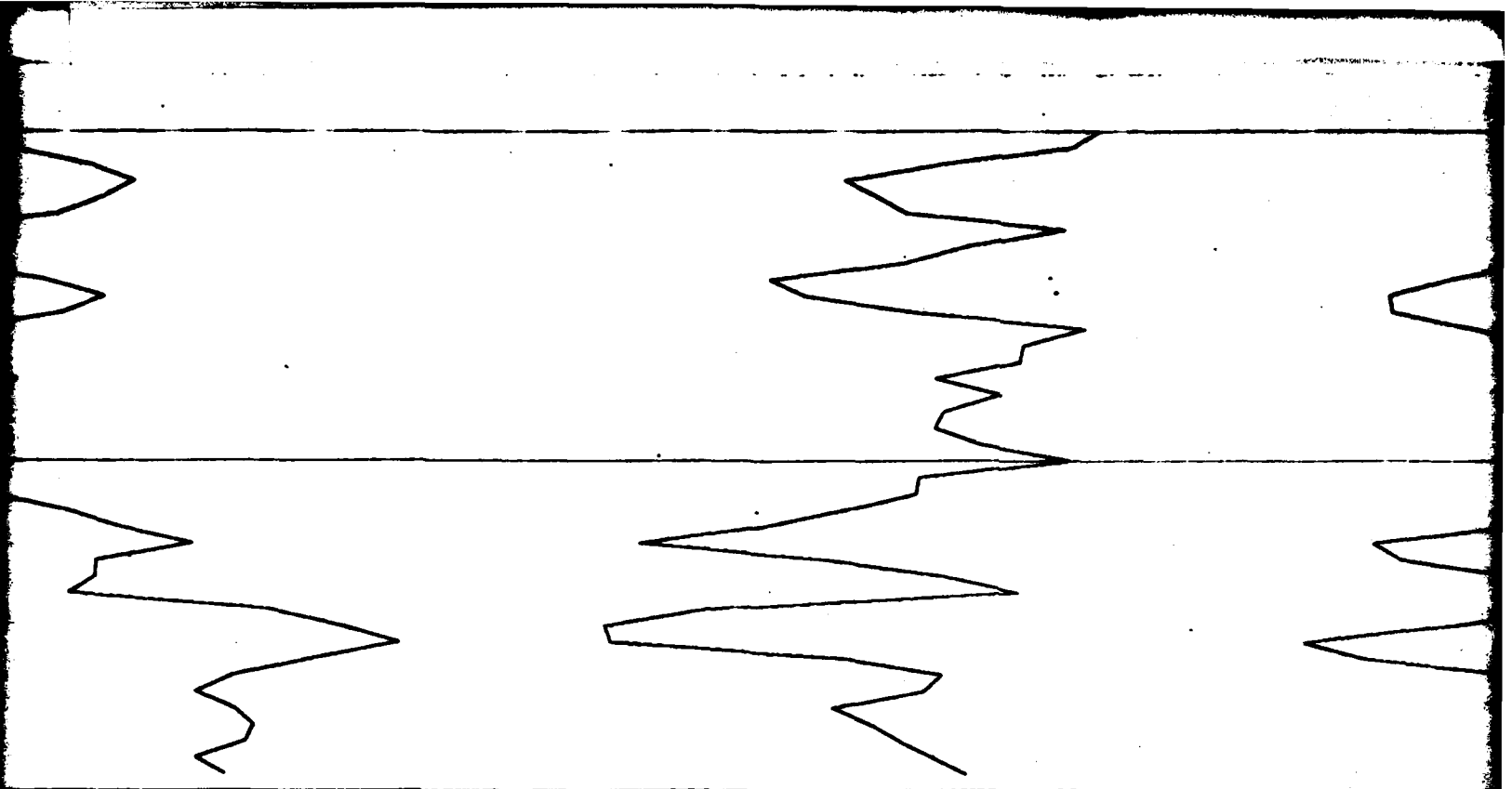
68

88



GM

05



1000

GG

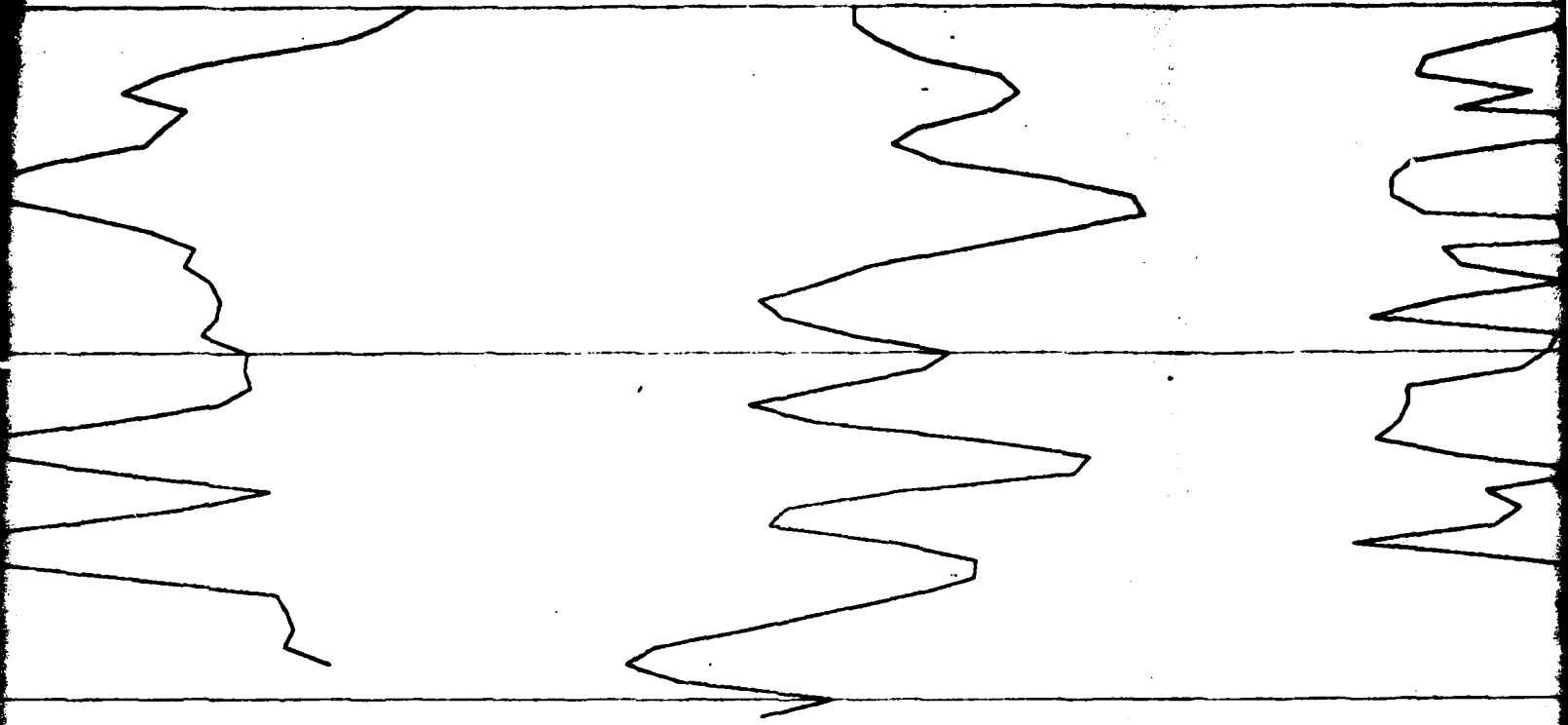
1

1000

1000

NG

h



10-10-10

20-10

1-10

10-10-10
NATC

3

WASHINGTON STATE UNIVERSITY

COLLEGE OF ENGINEERING

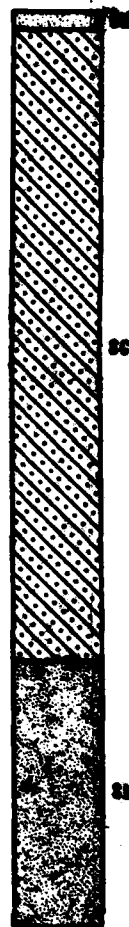
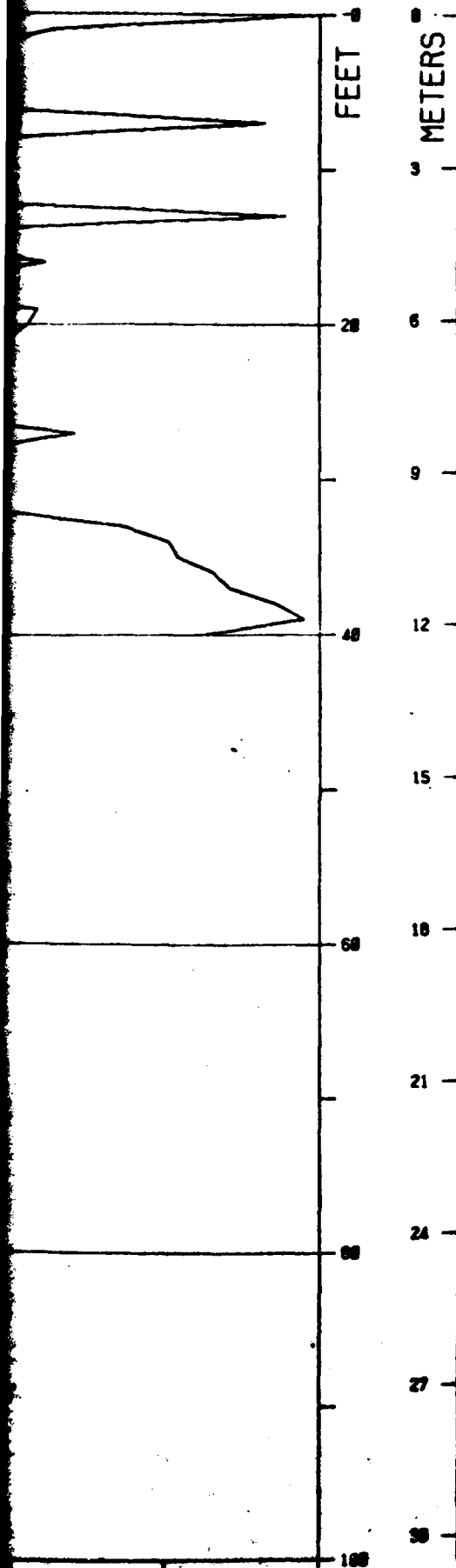
GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
BORING NO. LD-1-12
ELEVATION 540' (185m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 6/5/77
TOTAL DEPTH LOGGED . . . 41' (12m)
DEPTH TO WATER LEVEL . . —
REMARKS —

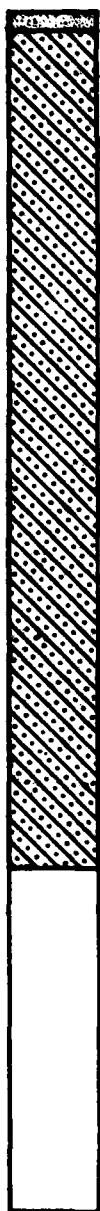
EXPLANATION

LOG TITLES	
NATG	- - NATURAL GAMMA
GG	- - GAMMA GAMMA
NN	- - NEUTRON NEUTRON
NG	- - NEUTRON GAMMA
FT	- - FLUID TEMPERATURE
FR	- - FLUID RESISTIVITY
CALP	- - CALIPER
SP	- - SPONTANEOUS POTENTIAL
RES	- - RESISTIVITY
FM	- - FLOW METER
GN	- - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
POROSITY (NN-LOG) INCREASES ←
WATER LEVEL

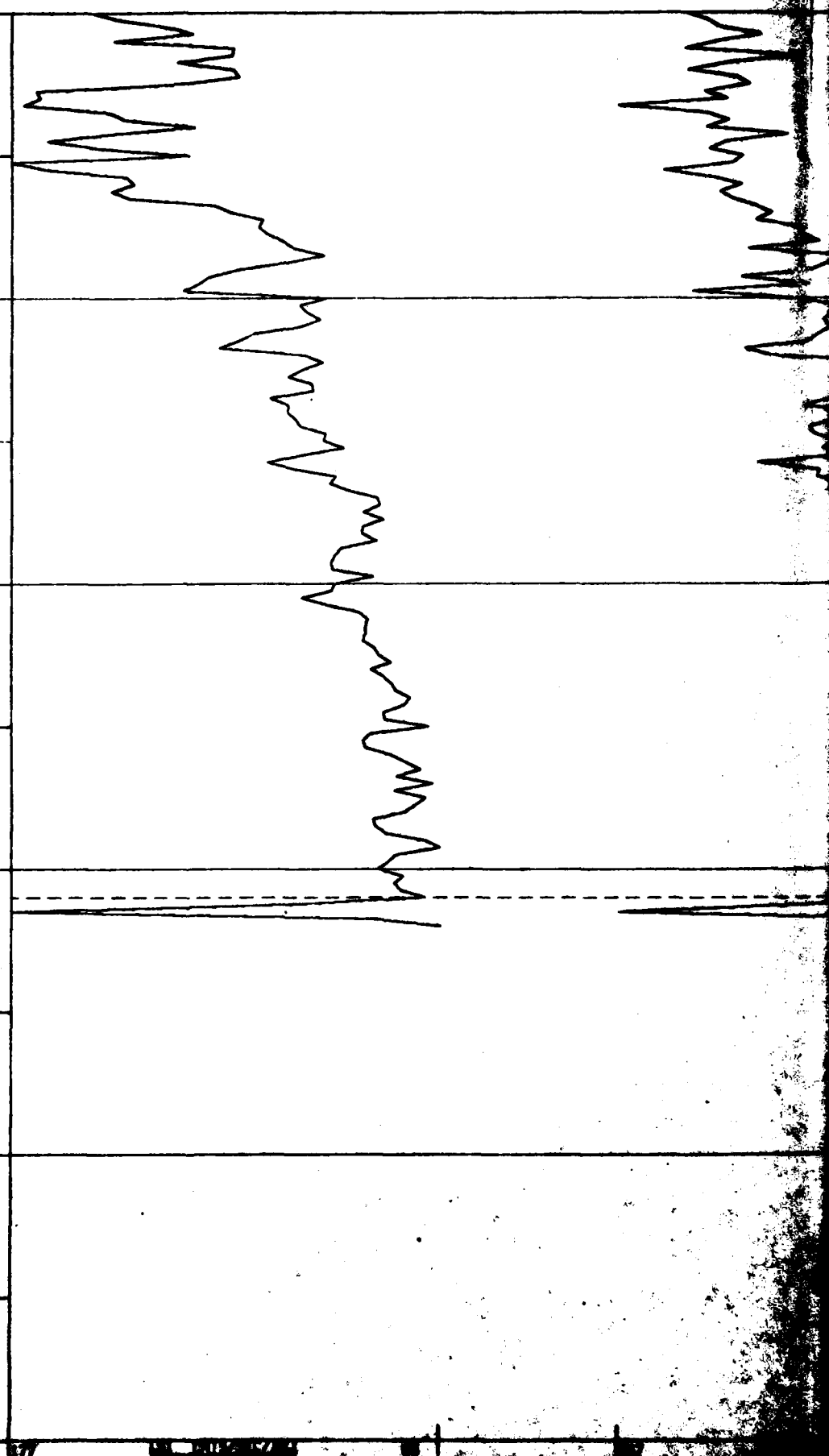
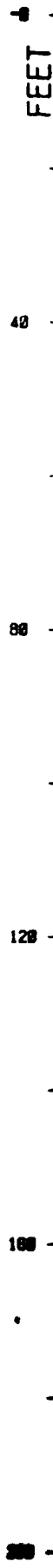
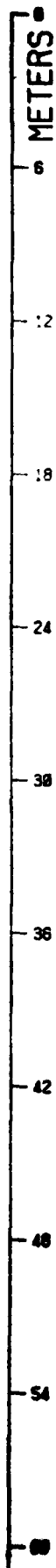


CALP 7.415

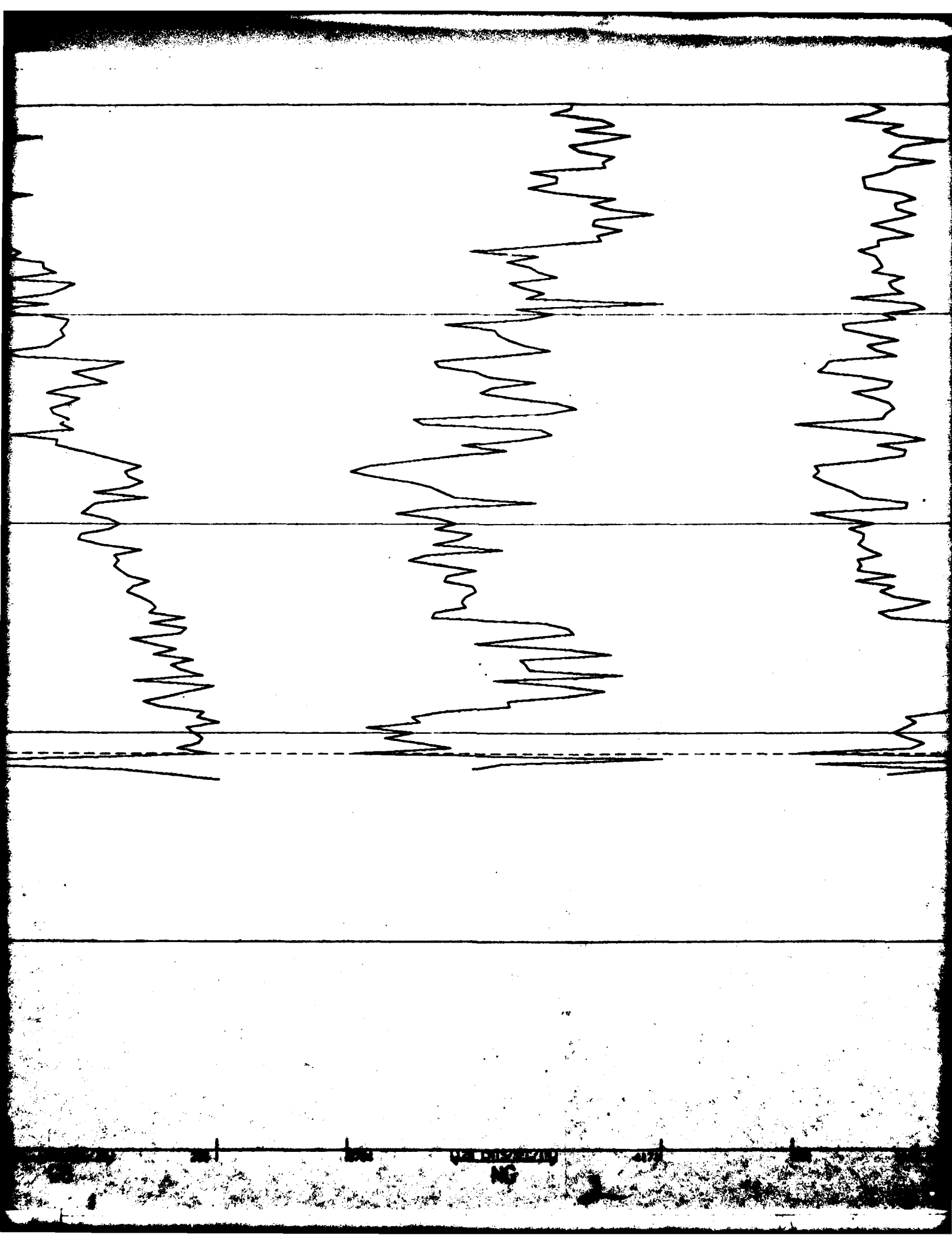


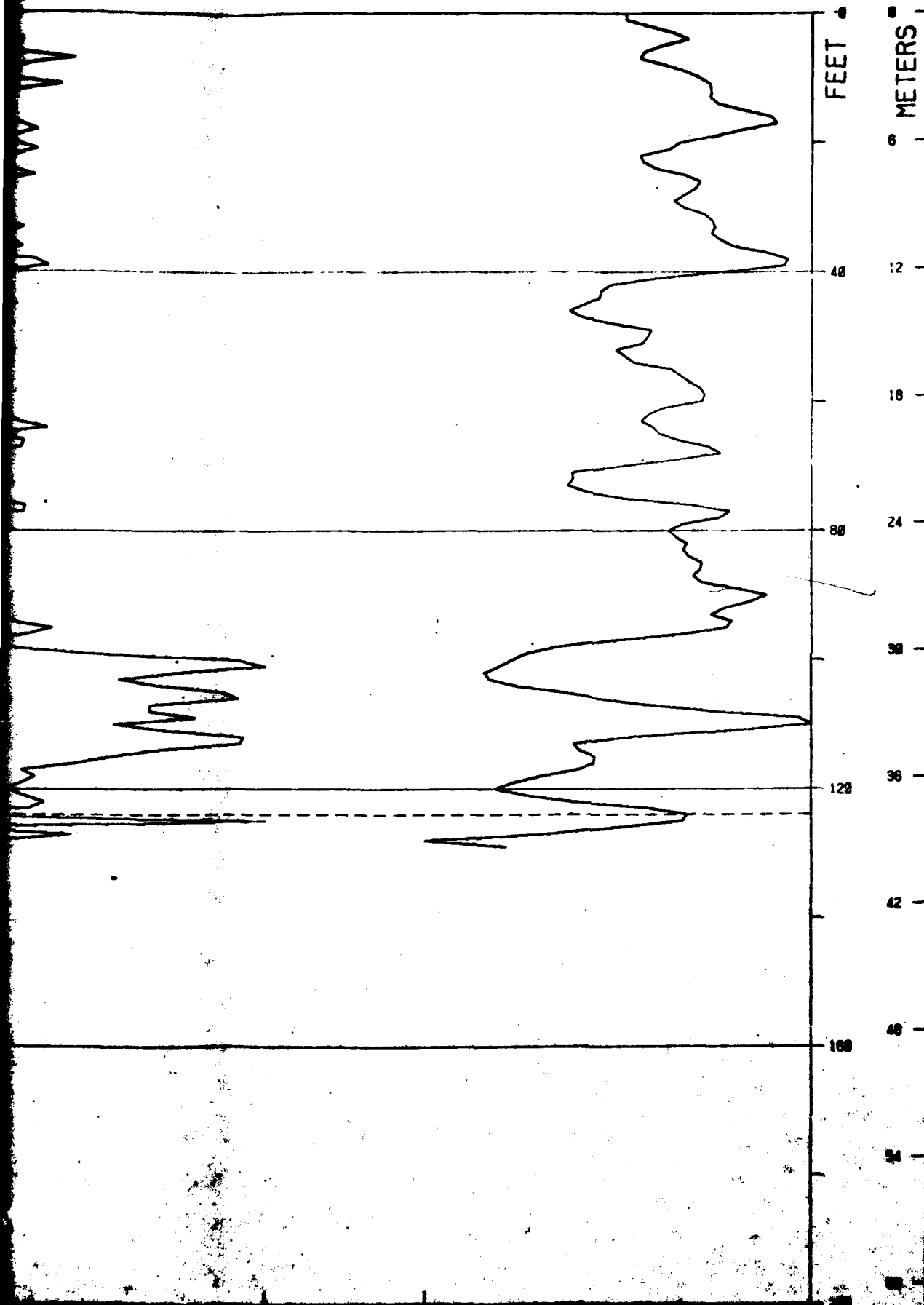
SM

SC



GM





1976

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COLLEGE OF ENGINEERING

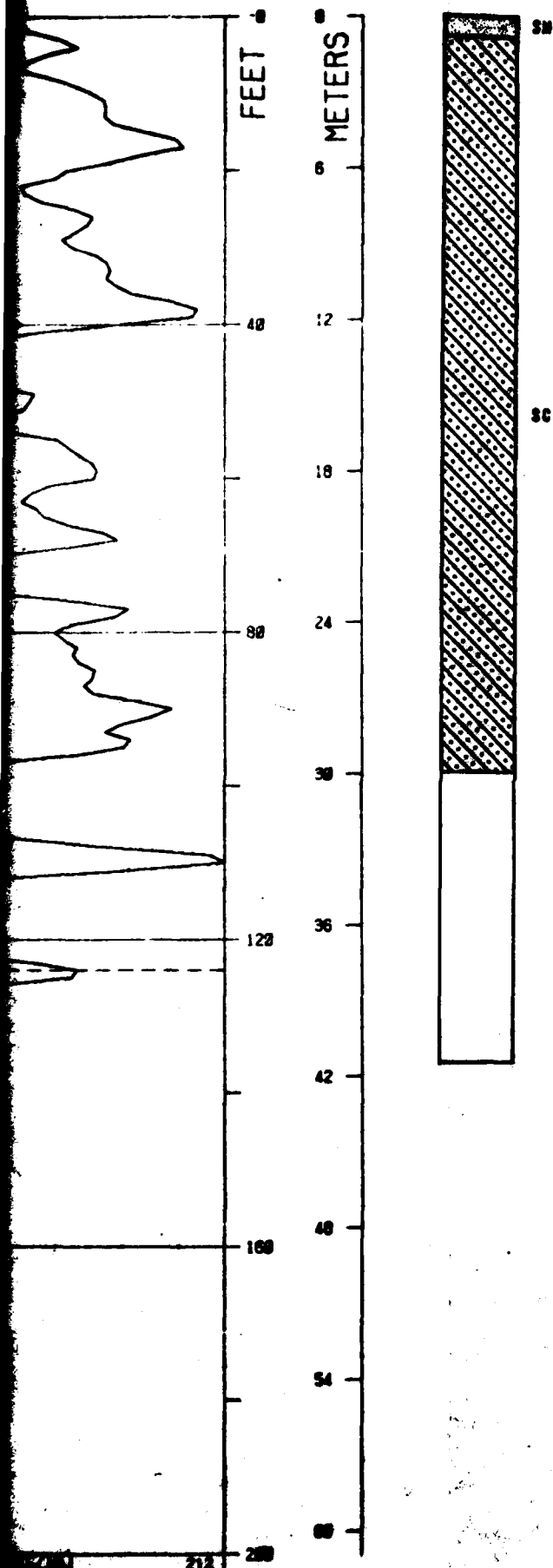
GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

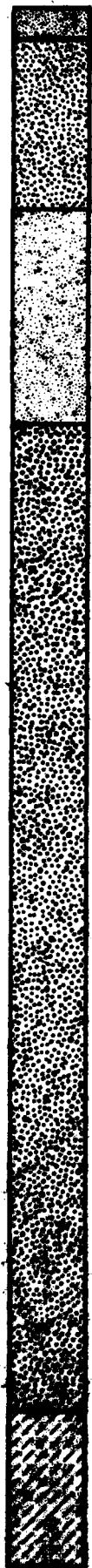
PROJECT NAME AIR FORCE
BORING NO. LD-8-1
ELEVATION 870' (285m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/16/77
TOTAL DEPTH LOGGED . . . 129' (39m)
DEPTH TO WATER LEVEL . . 125' (38m)
REMARKS —

EXPLANATION

LOG TITLES
NATG - - - NATURAL GAMMA
GG - - - GAMMA GAMMA
NN - - - NEUTRON NEUTRON
NG - - - NEUTRON GAMMA
FT - - - FLUID TEMPERATURE
FR - - - FLUID RESISTIVITY
CALP - - - CALIPER
SP - - - SPONTANEOUS POTENTIAL
RES - - - RESISTIVITY
FMTN - - - FLOW METER
GH - - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
POROSITY (NN-LOG) INCREASES ←
WATER LEVEL - - - -



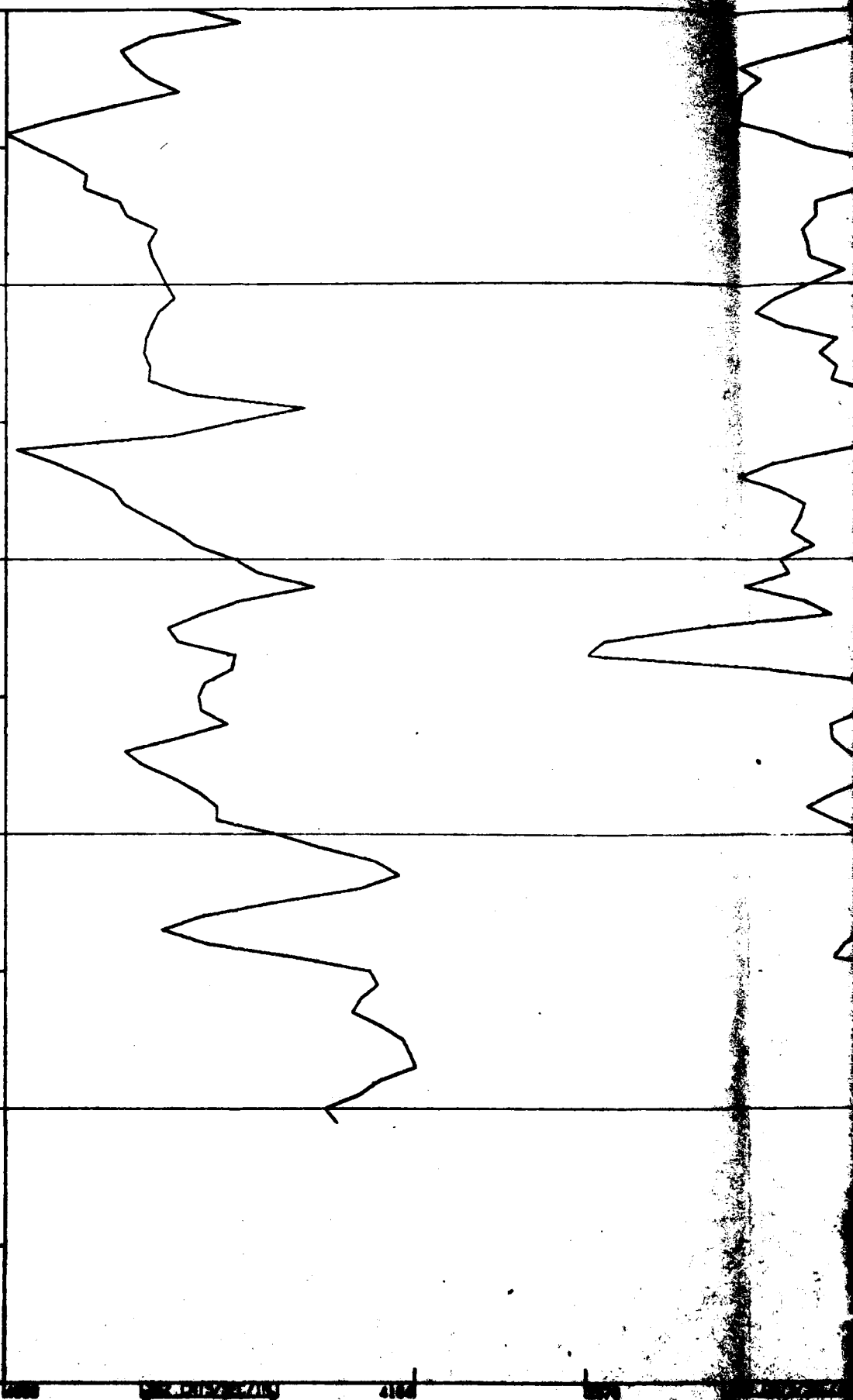


METERS

0 3 6 9 12 15 18 21 24 27 30

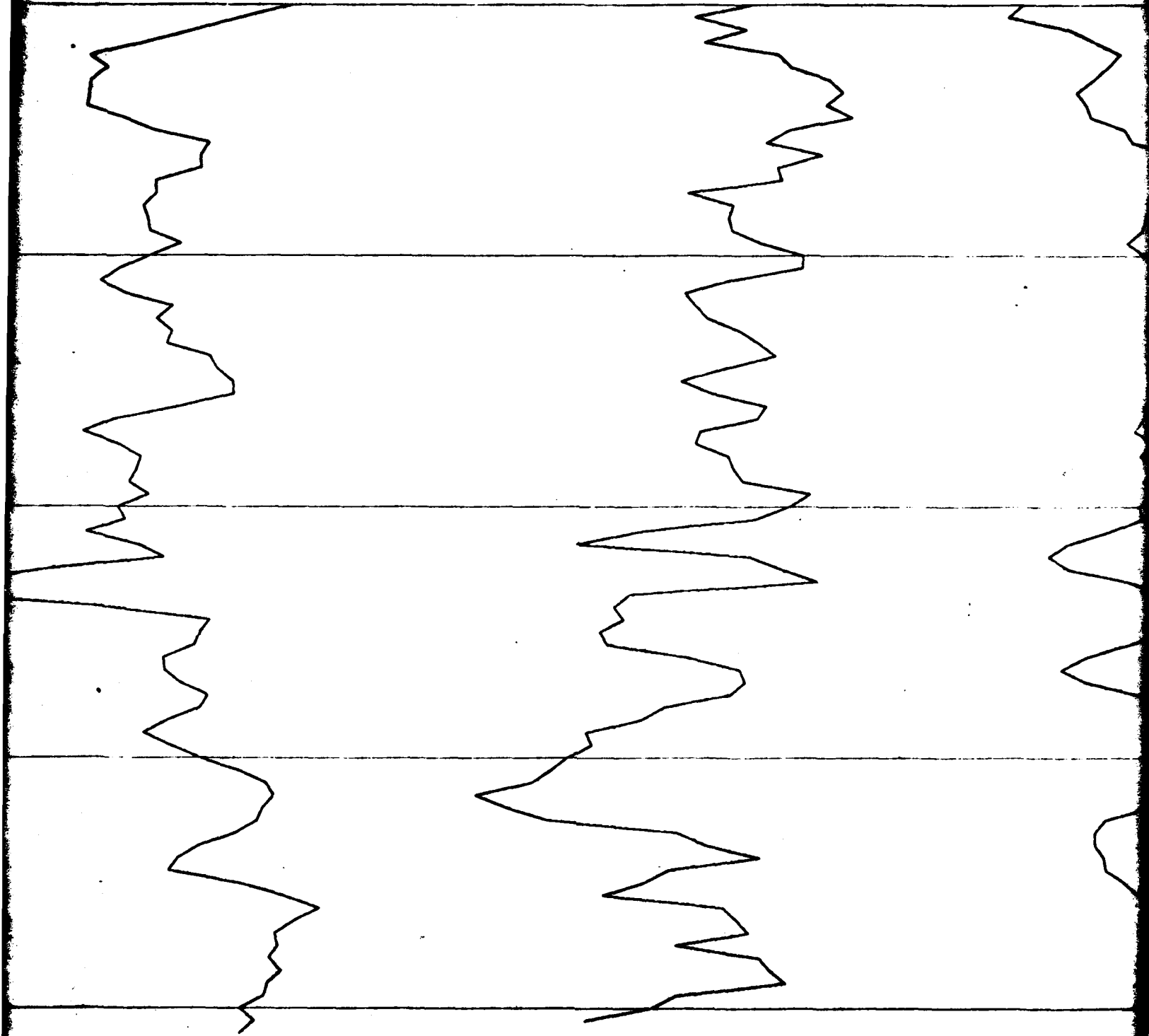
FEET

0 10 20 30 40 50 60 70 80 90 100



GM

GM



GG 2942

GG

1788

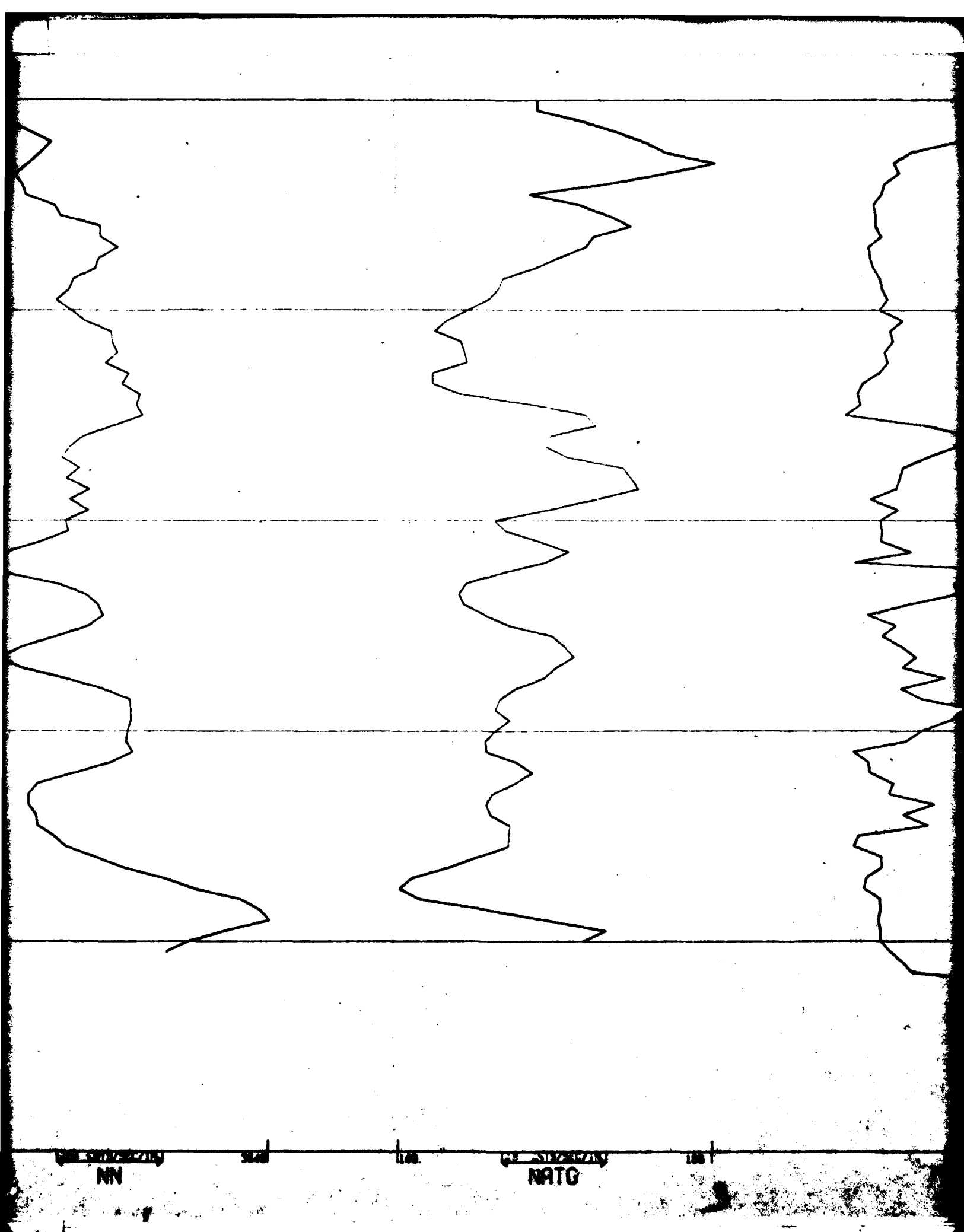
2574

NG 1798

NG

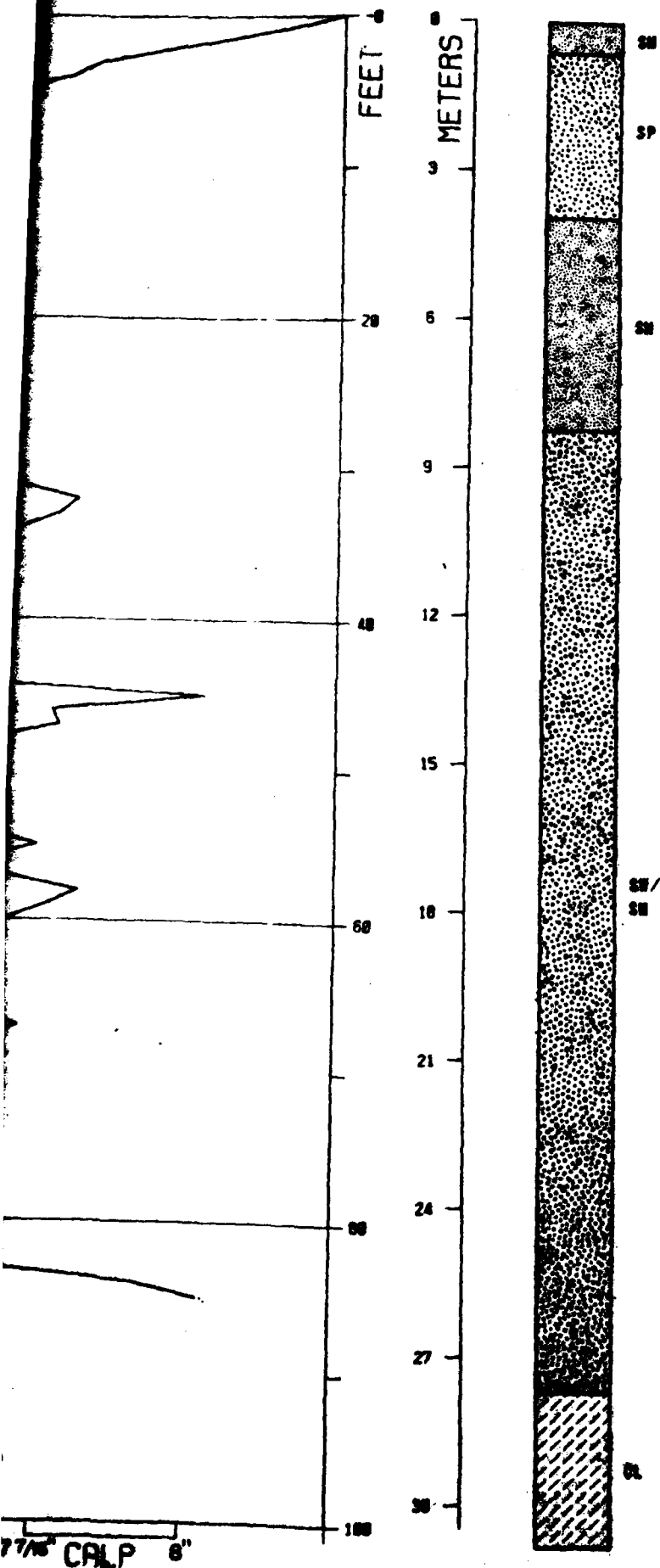
2942

1798



000 000 000 000
NN

000 000 000 000
NATG



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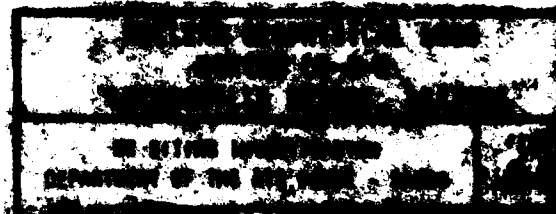
COLLEGE OF ENGINEERING

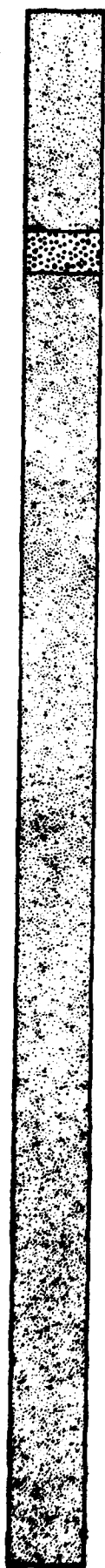
GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
BORING NO. LD-8-2
ELEVATION 400' (122m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 4/25/77
TOTAL DEPTH LOGGED 82' (25m)
DEPTH TO WATER LEVEL
REMARKS

EXPLANATION
LOG TITLES
NATC - - - NATURAL GAMMA
CG - - - GAMMA GAMMA
NN - - - NEUTRON NEUTRON
NG - - - NEUTRON GAMMA
FT - - - FLUID TEMPERATURE
FR - - - FLUID RESISTIVITY
CALP - - - CALIPER
SP - - - SPONTANEOUS POTENTIAL
WRES - - - RESISTIVITY
FMTR - - - FLOW METER
GA - - - DELTA GAMMA

DENSITY (CG-LOG) INCREASES →
POROSITY (NN-LOG) INCREASES ←
WATER LEVEL - - - - -





SM

SW/
SM

SM

METERS

FEET

3

6

9

12

15

18

21

24

27

30

28

48

68

88

100 4720

300 CM/SEC/IN

3000

12000

GM

1001

1005

1009 01/12/2010

NG

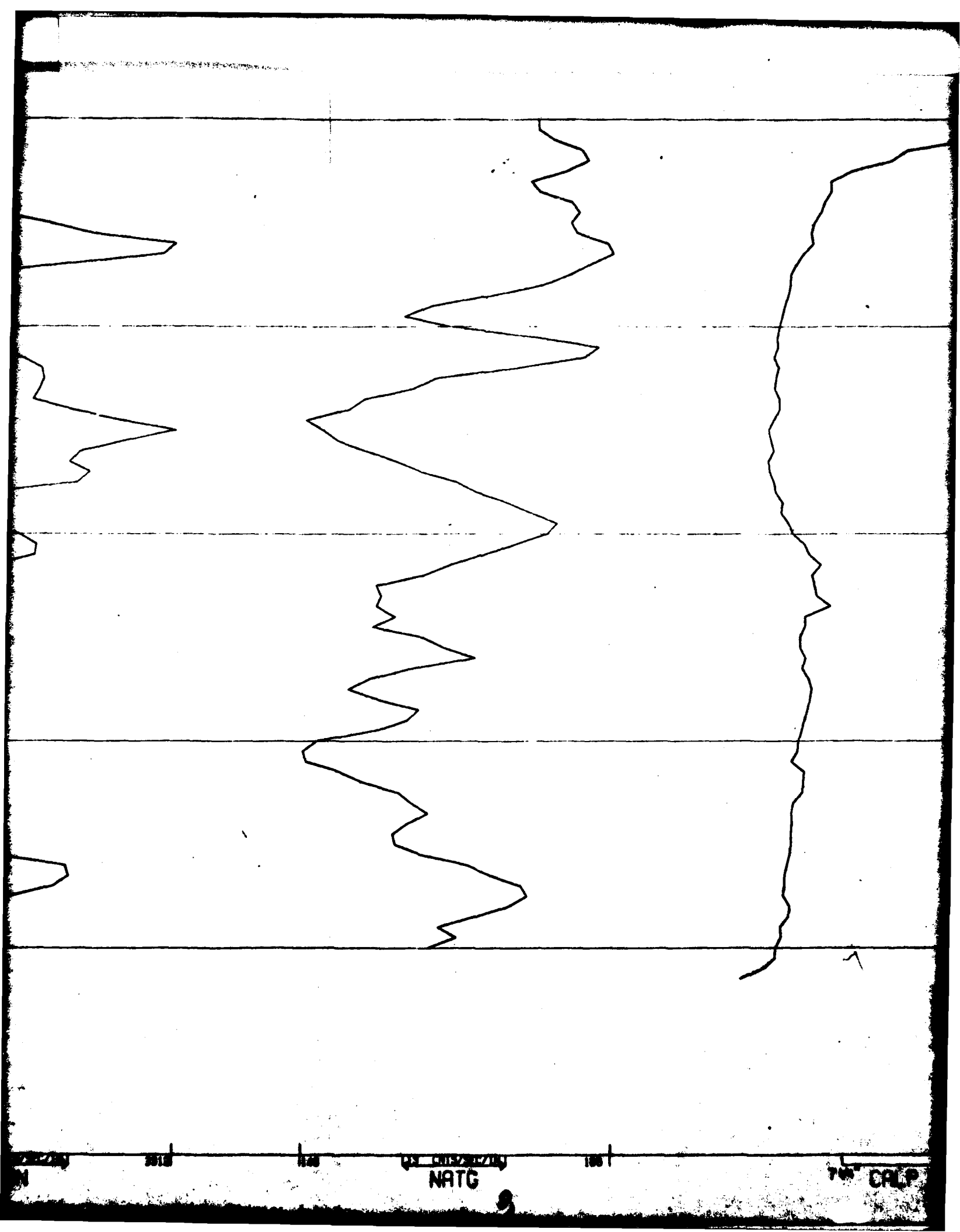
1013

1017

1021 01/12/2010

NN

2



NATC

CALP

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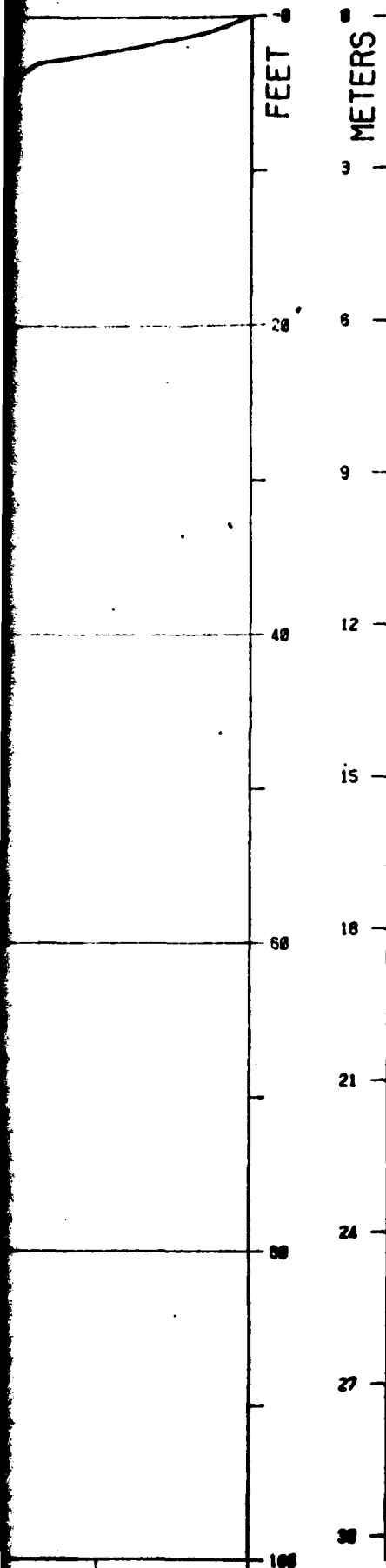
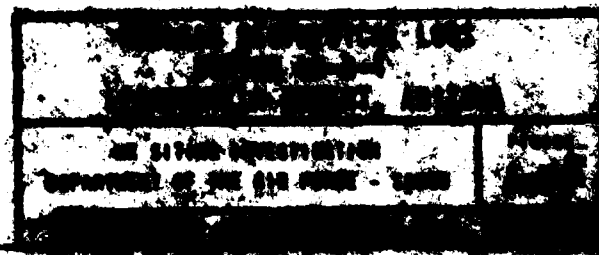
COLLEGE OF ENGINEERING

GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
BORING NO. LD-B-4
ELEVATION 740' (228m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 4/26/77
TOTAL DEPTH LOGGED 82' (25m)
DEPTH TO WATER LEVEL
REMARKS

EXPLANATION
LOG TITLES
NATG - - NATURAL GAMMA
GG - - GAMMA GAMMA
NN - - NEUTRON NEUTRON
NG - - NEUTRON GAMMA
FT - - FLUID TEMPERATURE
FR - - FLUID RESISTIVITY
CALP - - CALIPER
SP - - SPONTANEOUS POTENTIAL
WRES - - RESISTIVITY
FMTR - - FLOW METER
GM - - DELTA GAMMA

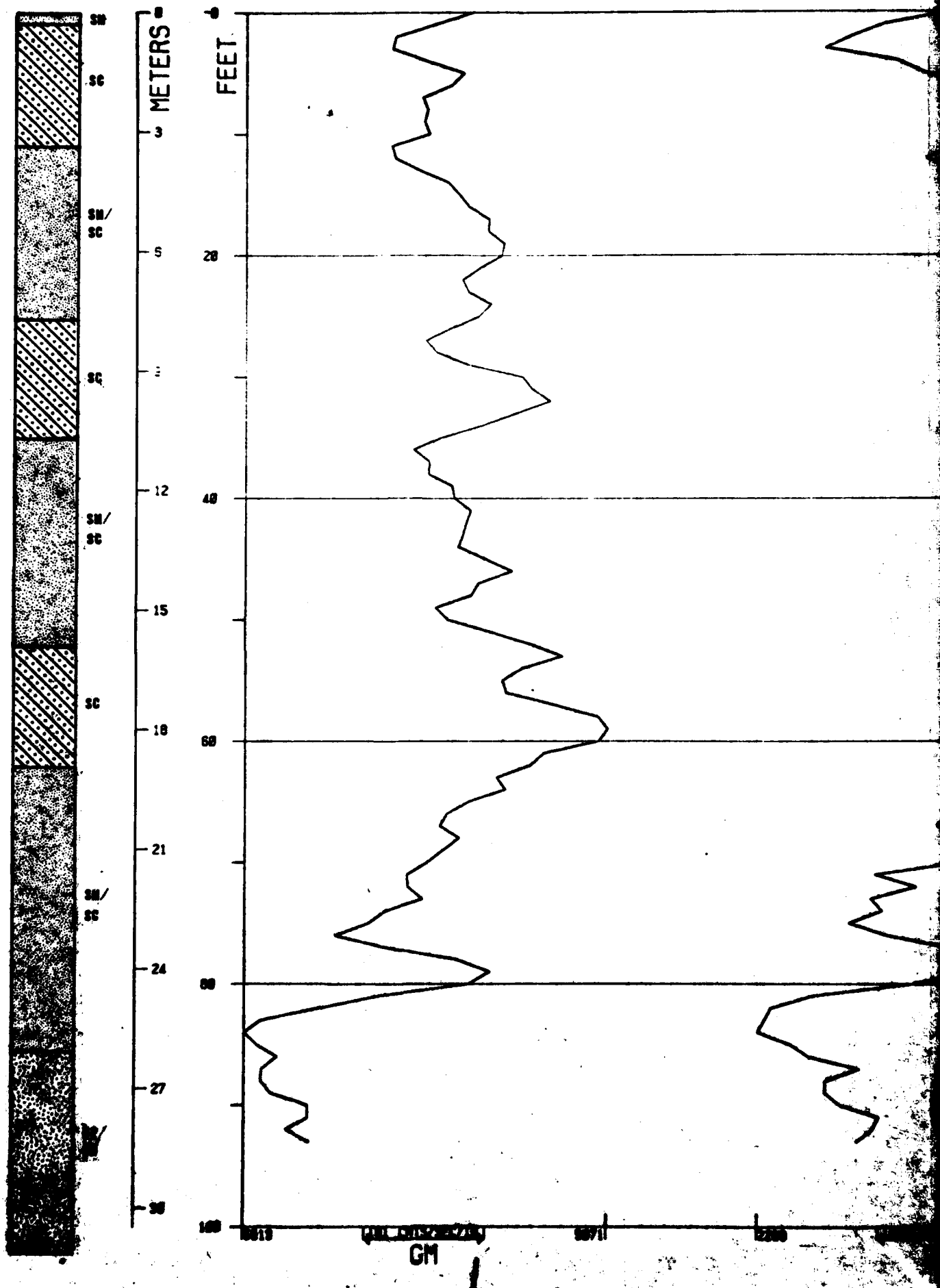
DENSITY (GG-LOG) INCREASES →
POROSITY (NN-LOG) INCREASES ←
WATER LEVEL - - - -

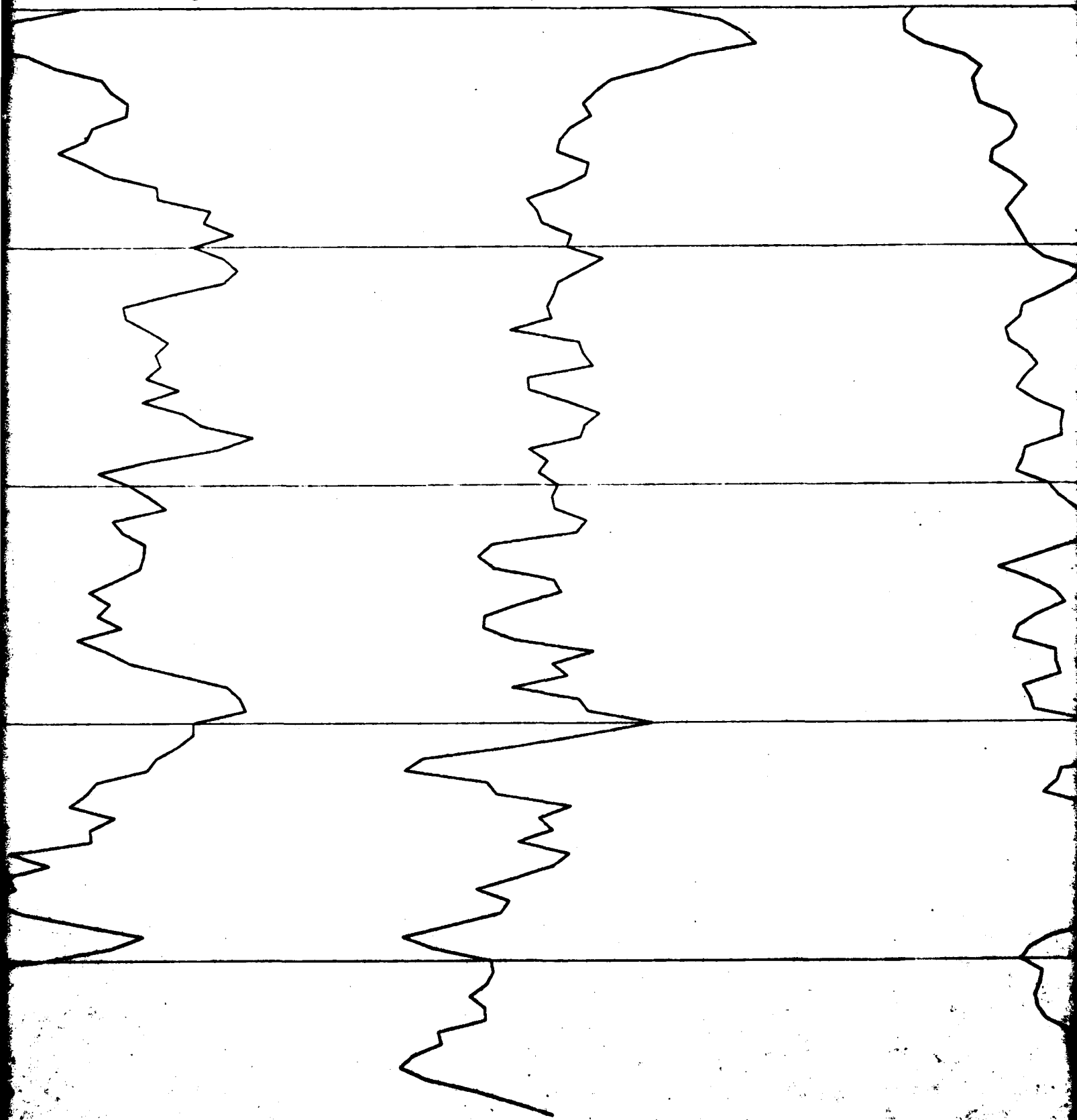


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22/

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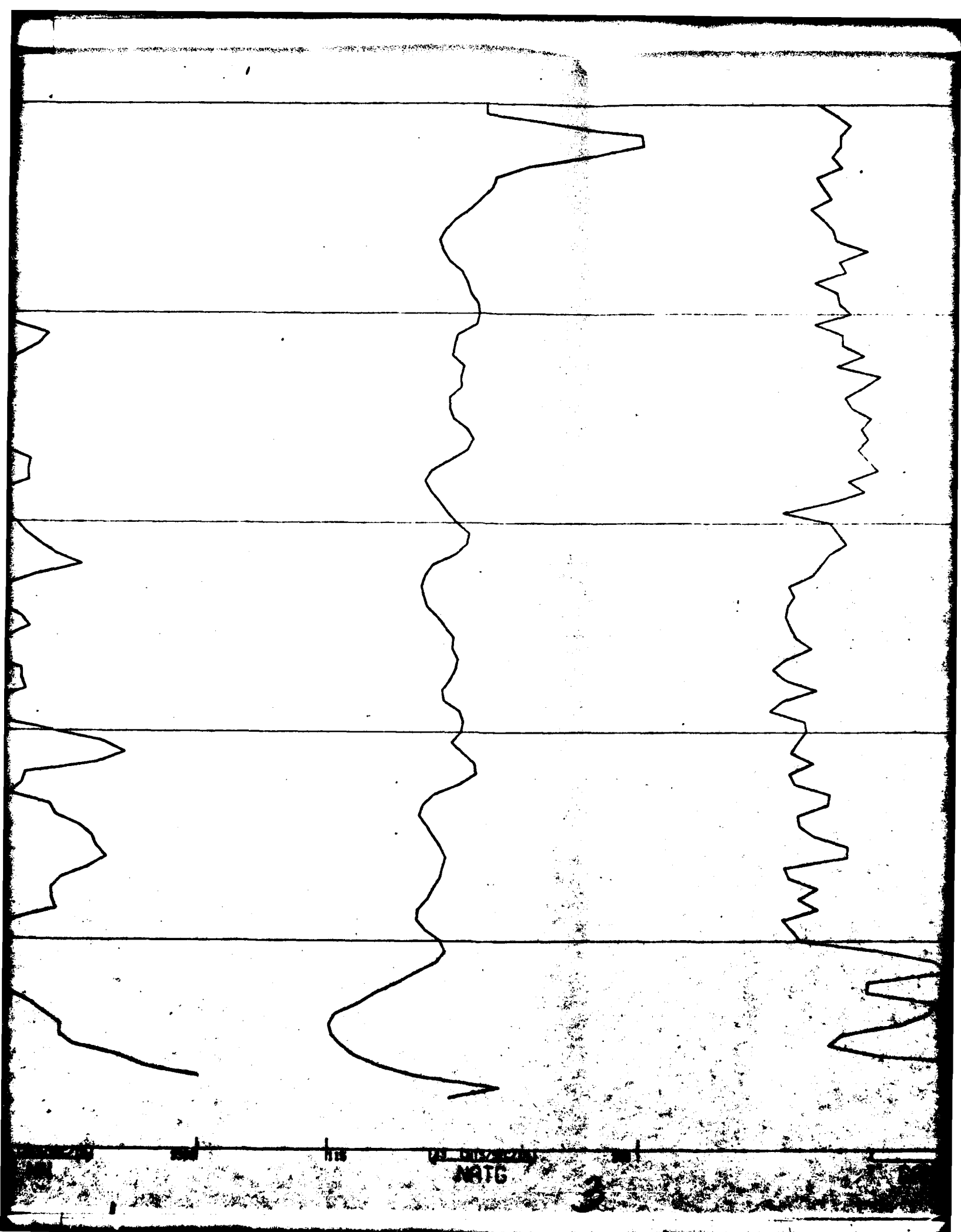




EC

NG

2



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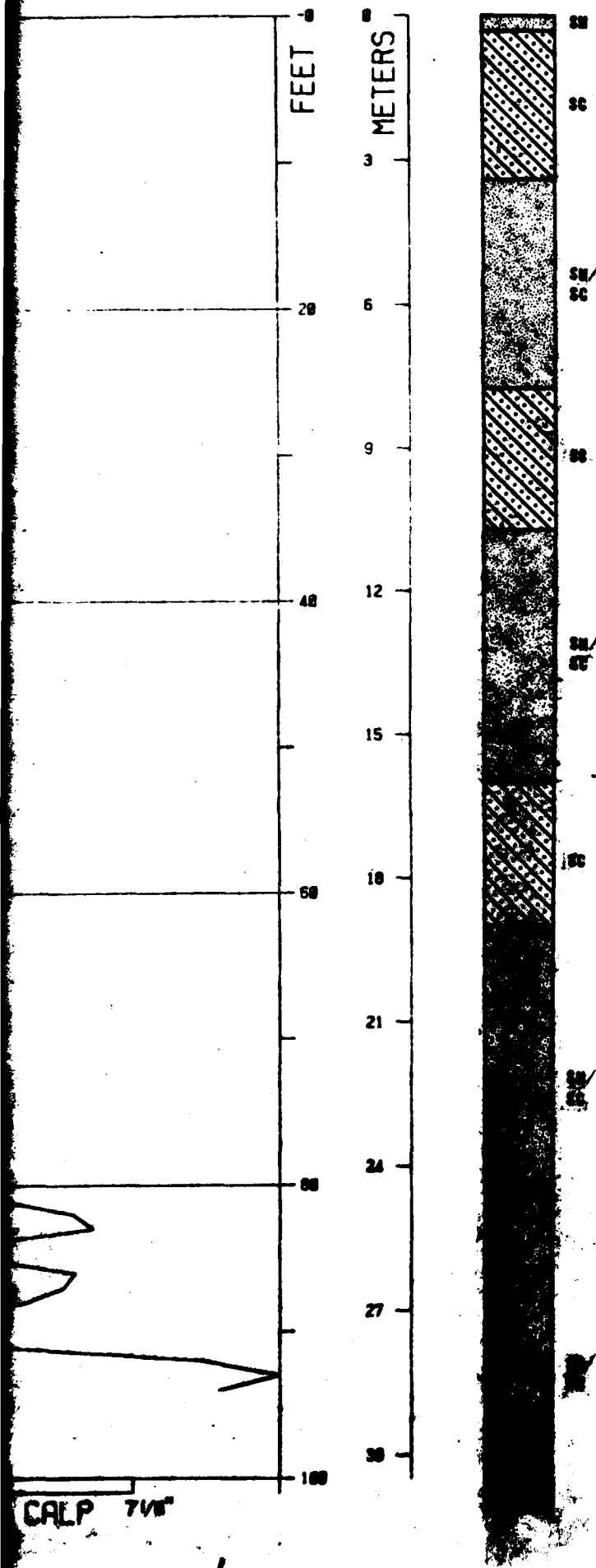
COLLEGE OF ENGINEERING

GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

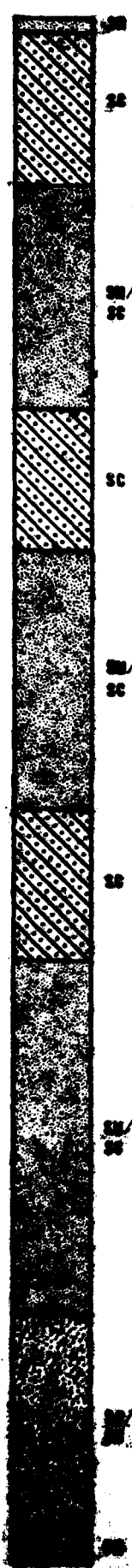
PROJECT NAME AIR FORCE
 BORING NO. LD-B-7
 ELEVATION 710' (230m)
 STATE ARIZONA
 COUNTY YUMA
 STUDY AREA LECHUGUILLA DES.
 DATE LOGGED 5/7/77
 TOTAL DEPTH LOGGED 94' (28m)
 DEPTH TO WATER LEVEL
 REMARKS

EXPLANATION
 LOG TITLES
 NATG - - - NATURAL GAMMA
 GG - - - GAMMA GAMMA
 NN - - - NEUTRON NEUTRON
 NG - - - NEUTRON GAMMA
 FT - - - FLUID TEMPERATURE
 PR - - - FLUID RESISTIVITY
 CALP - - - CALIPER
 SP - - - SPONTANEOUS POTENTIAL
 WRES - - - RESISTIVITY
 FPM - - - FLOW METER
 GH - - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
 POROSITY (NN-LOG) INCREASES ←
 WATER LEVEL -----



CALP 710'

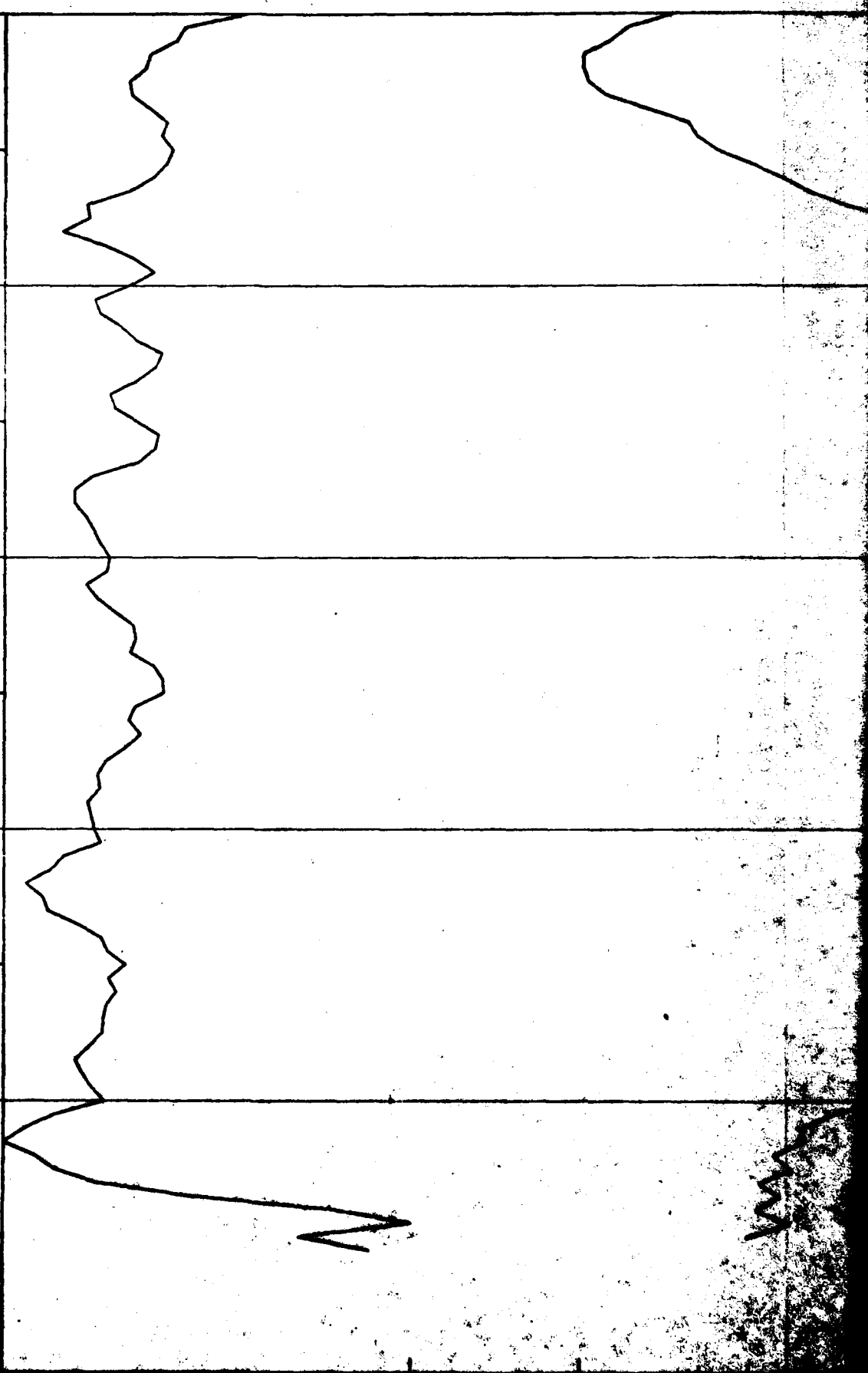


METERS

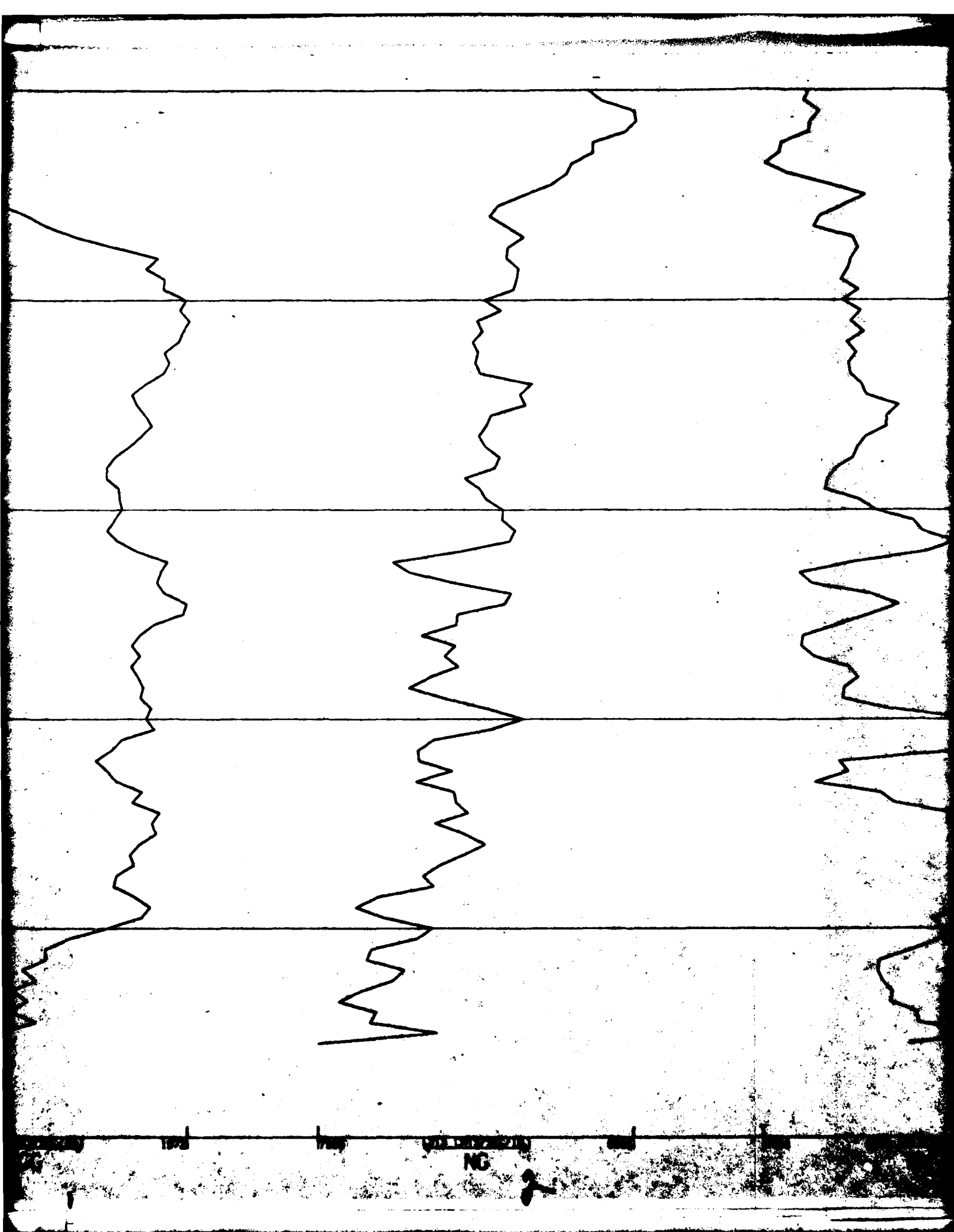
1
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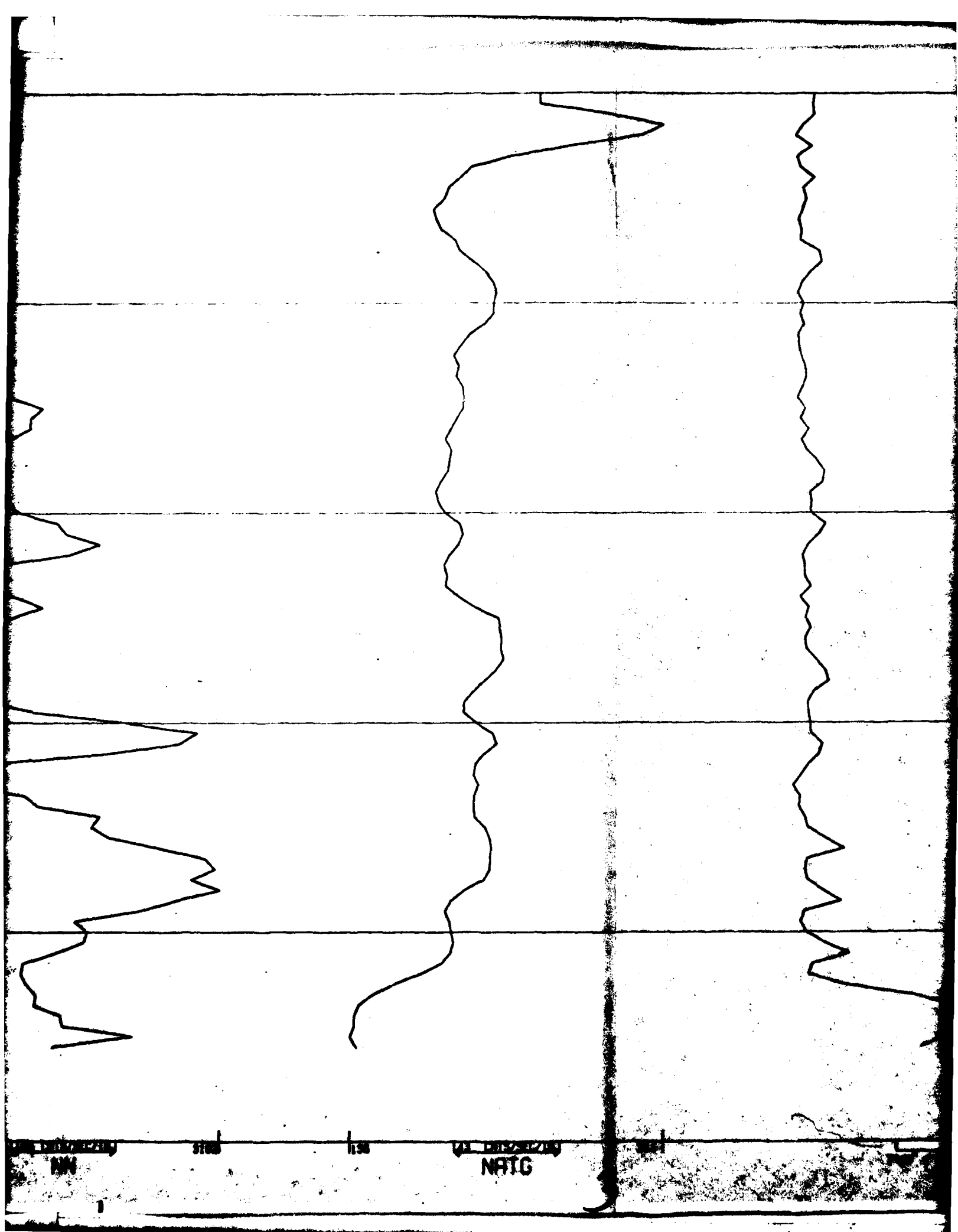
FEET

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GN





1

NATC

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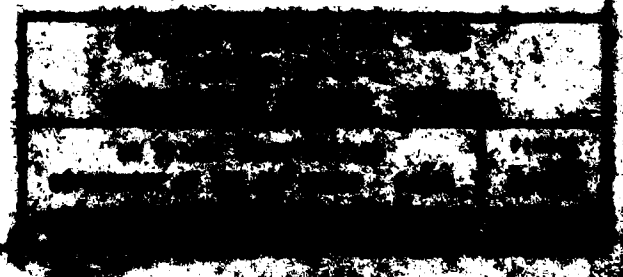
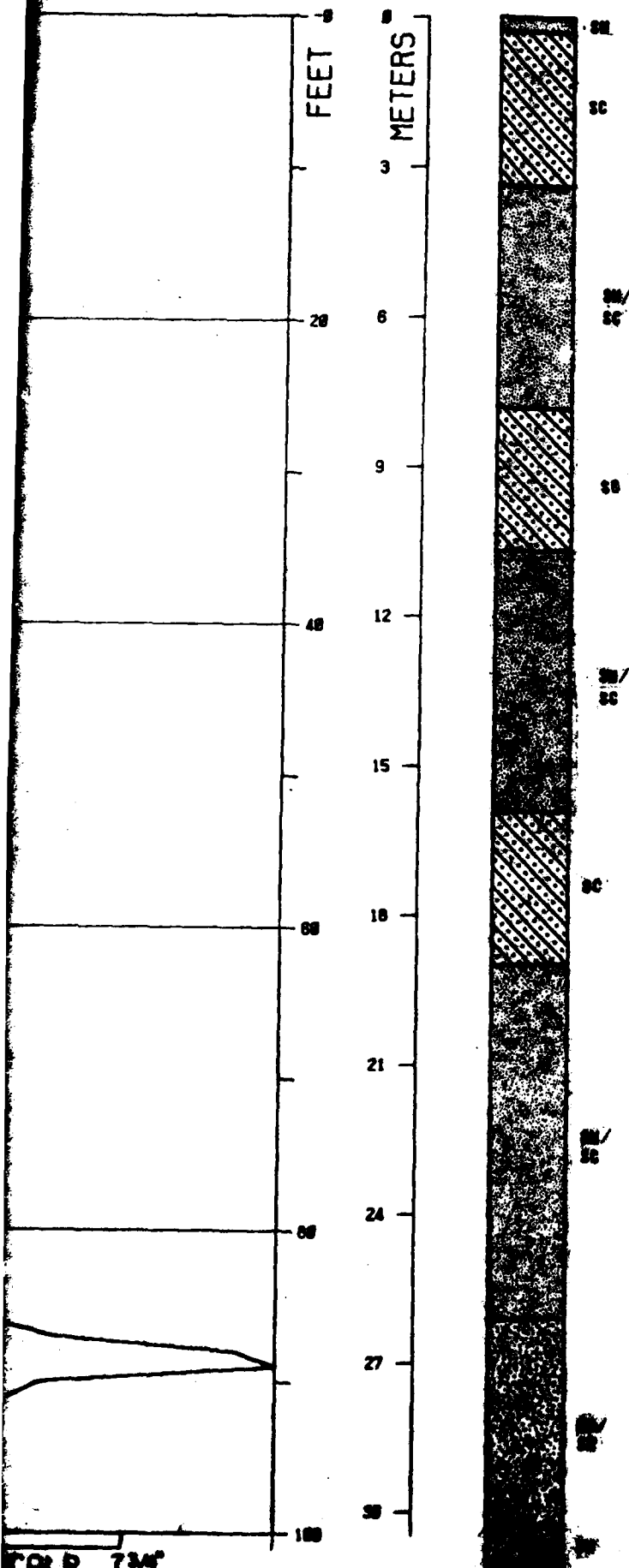
COLLEGE OF ENGINEERING

GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
BORING NO. LD-8-8
ELEVATION 710' (216m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/7/77
TOTAL DEPTH LOGGED 91' (28m)
DEPTH TO WATER LEVEL
REMARKS

EXPLANATION
LOG TITLES
NATG - - - NATURAL GAMMA
GG - - - GAMMA GAMMA
NN - - - NEUTRON NEUTRON
NG - - - NEUTRON GAMMA
FT - - - FLUID TEMPERATURE
FR - - - FLUID RESISTIVITY
CALP - - - CALIPER
SP - - - SPONTANEOUS POTENTIAL
RES - - - RESISTIVITY
FMTA - - - FLOW METER
GN - - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
POROSITY (NN-LOG) INCREASES ←
WATER LEVEL



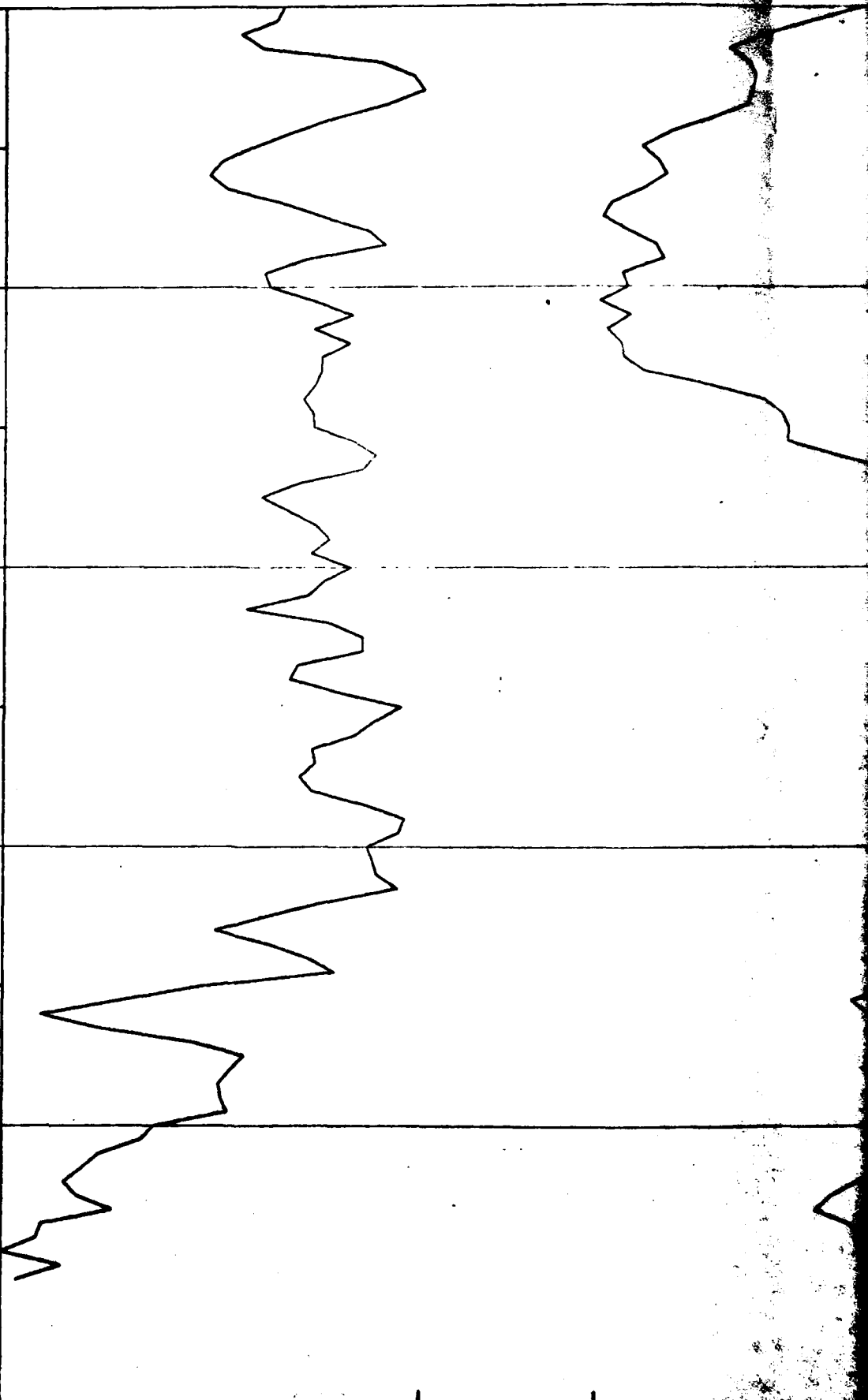


METERS

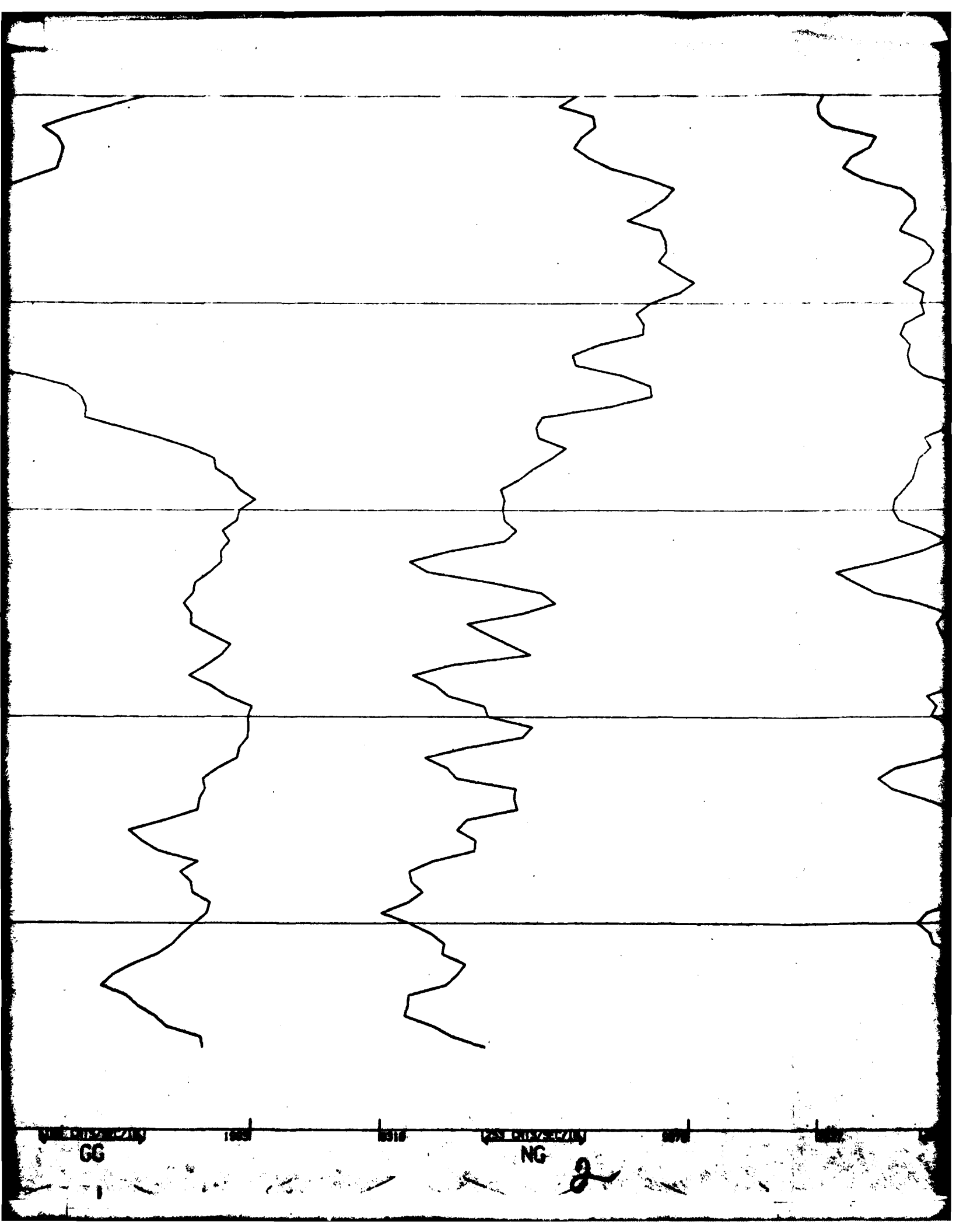
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FEET

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GM



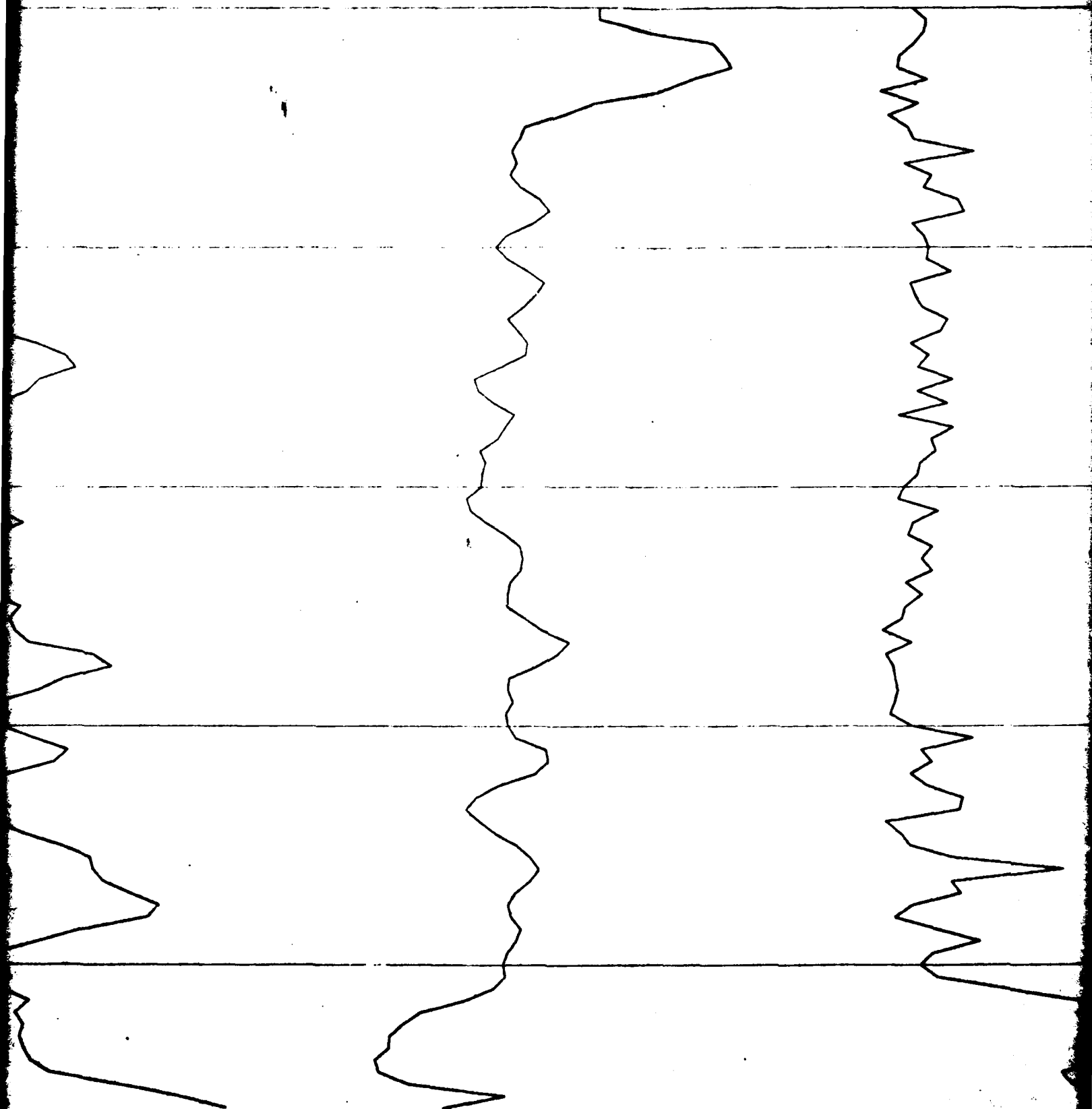
1950 1951 1952 1953 1954

GG

1950 1951 1952 1953 1954

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NN

NATG

9

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COLLEGE OF ENGINEERING

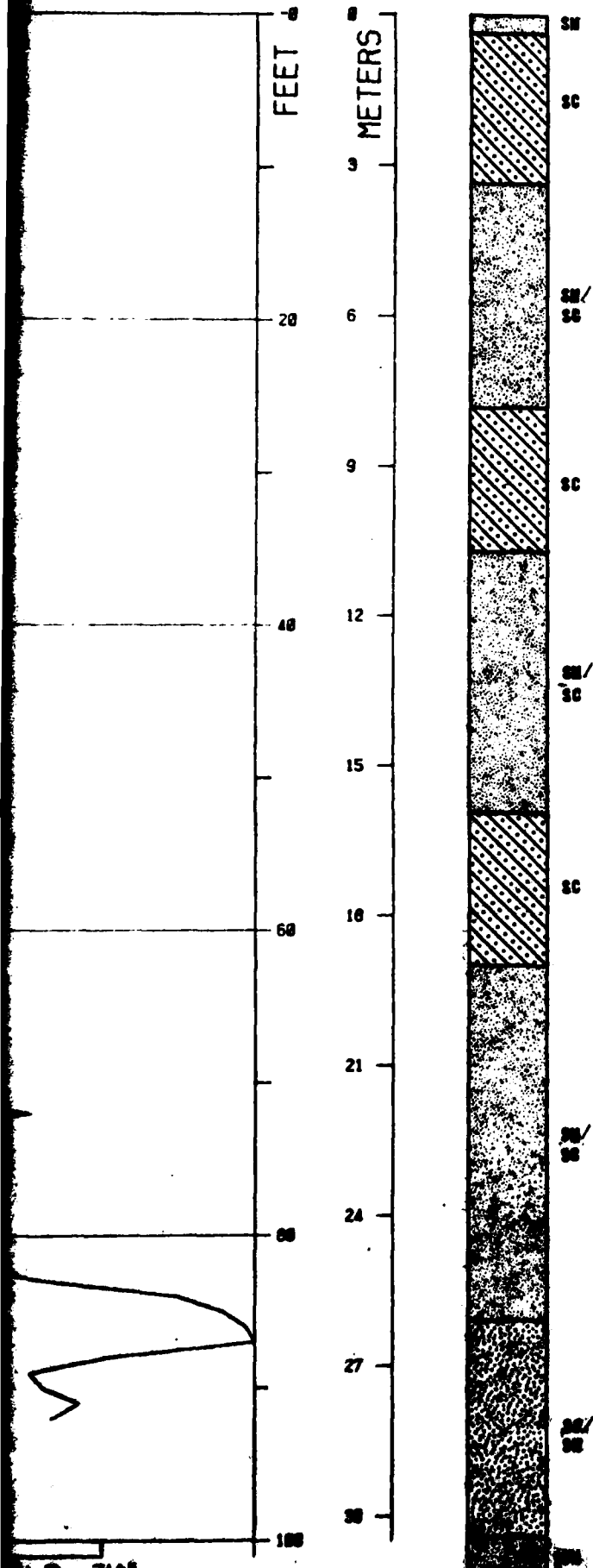
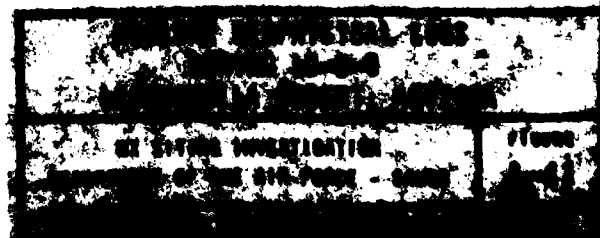
GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
 BORING NO. LD-B 9
 ELEVATION 710' (216m)
 STATE ARIZONA
 COUNTY YUMA
 STUDY AREA LECHUGUILLA DES.
 DATE LOGGED 5/10/77
 TOTAL DEPTH LOGGED . . 92' (28m)
 DEPTH TO WATER LEVEL . . —
 REMARKS —

LOG TITLES

NATG	-	NATURAL GAMMA
GG	-	GAMMA GAMMA
NN	-	NEUTRON NEUTRON
NG	-	NEUTRON GAMMA
FT	-	FLUID TEMPERATURE
FR	-	FLUID RESISTIVITY
CALP	-	CALIPER
SP	-	SPONTANEOUS POTENTIAL
WRES	-	RESISTIVITY
FMTR	-	FLOW METER
GM	-	DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
 POROSITY (NN-LOG) INCREASES ←
 WATER LEVEL -----



LP 71A

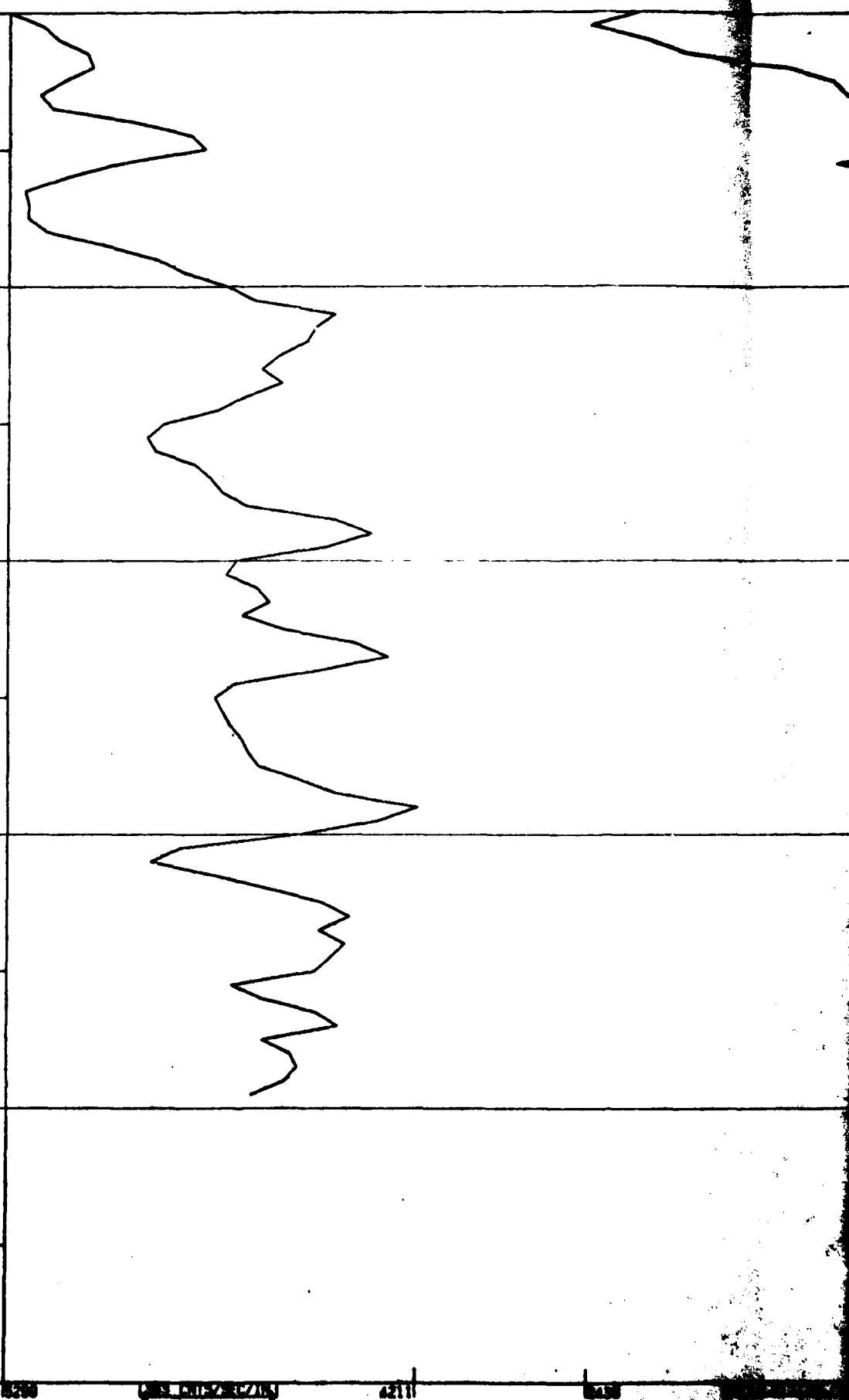


METERS

3
6
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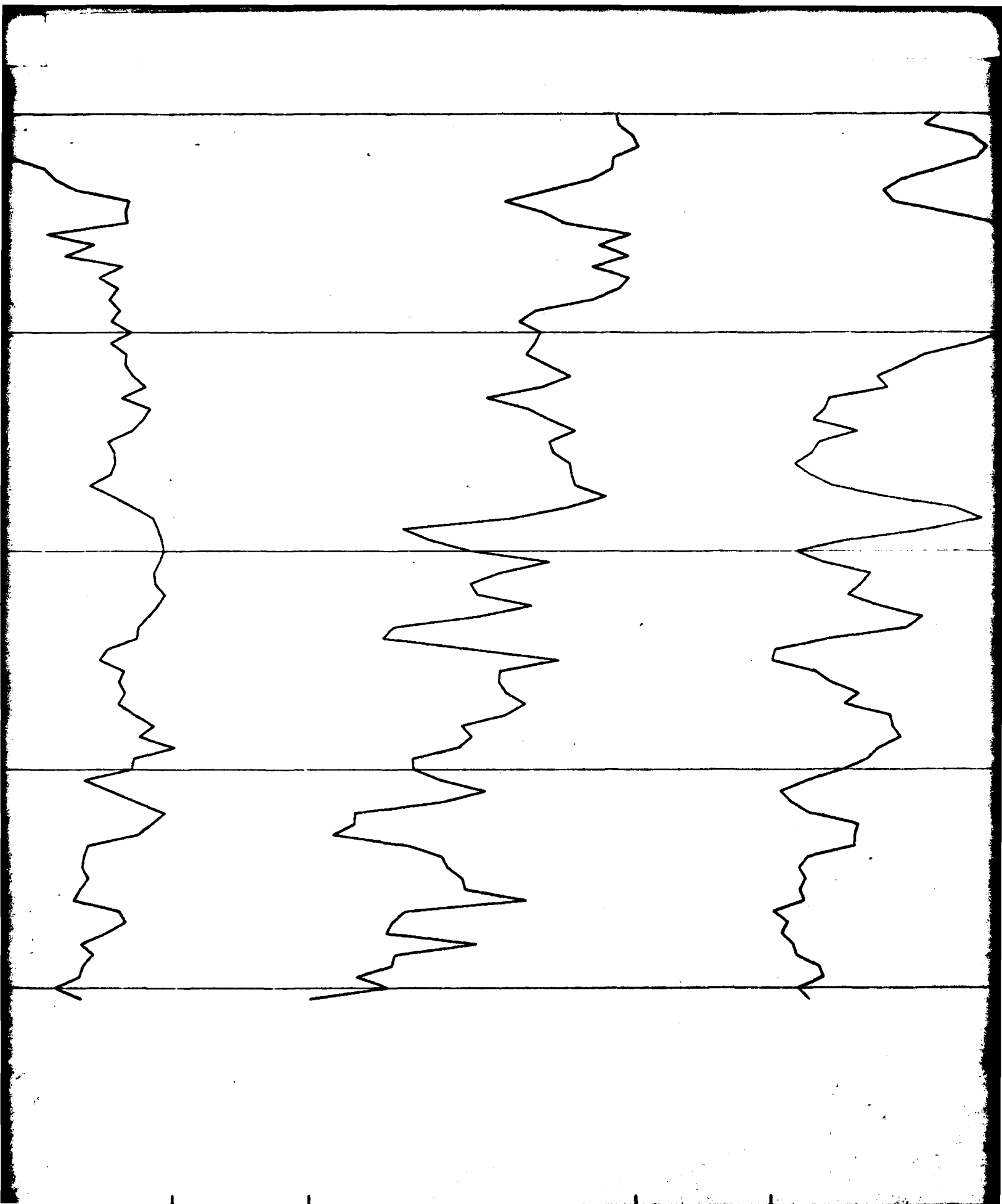
FEET

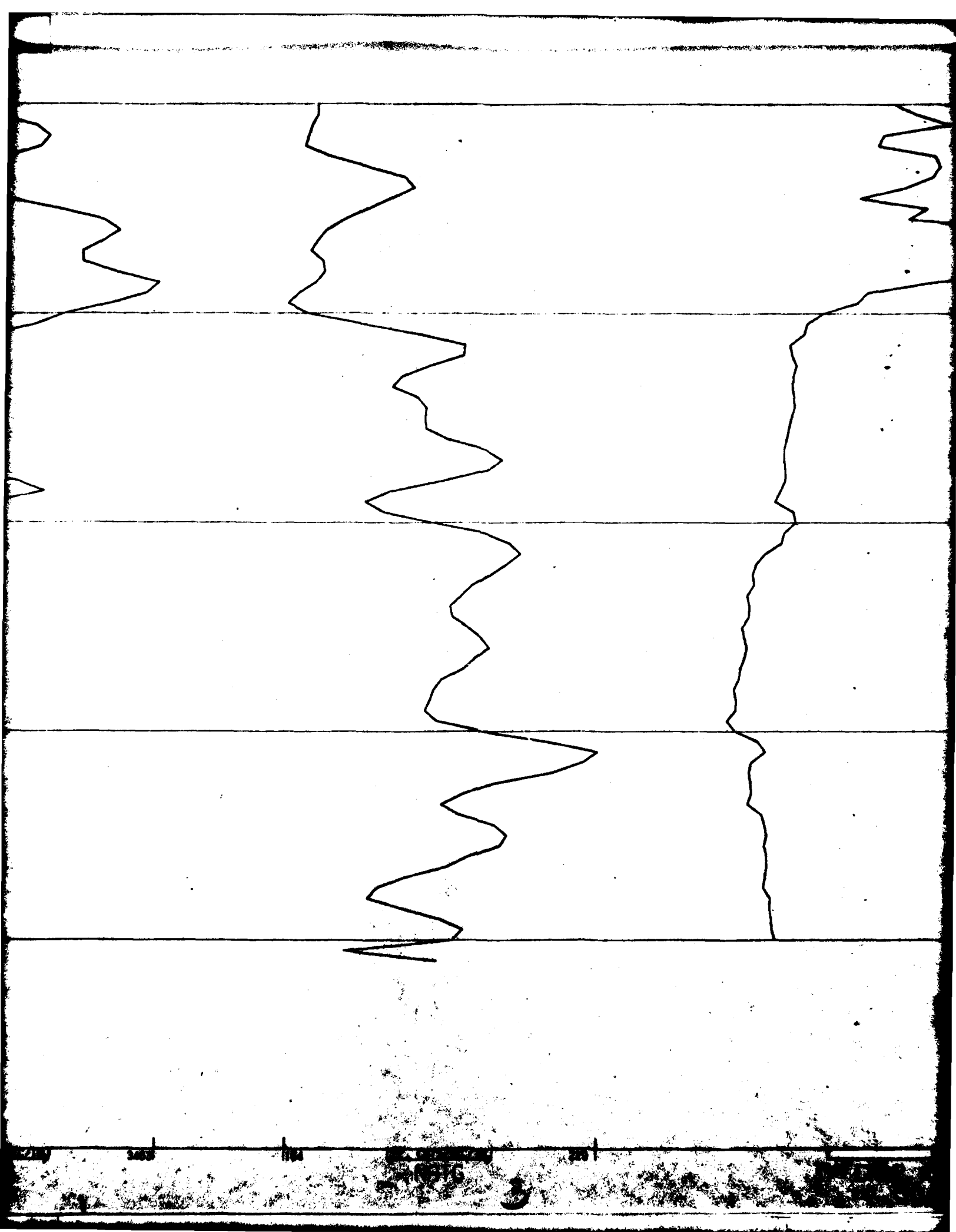
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100



DATE: 11-2-12/11

GM





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GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

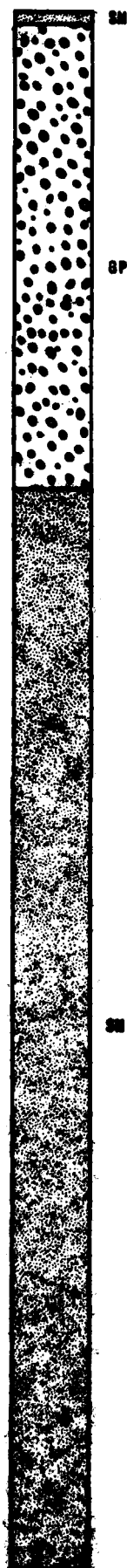
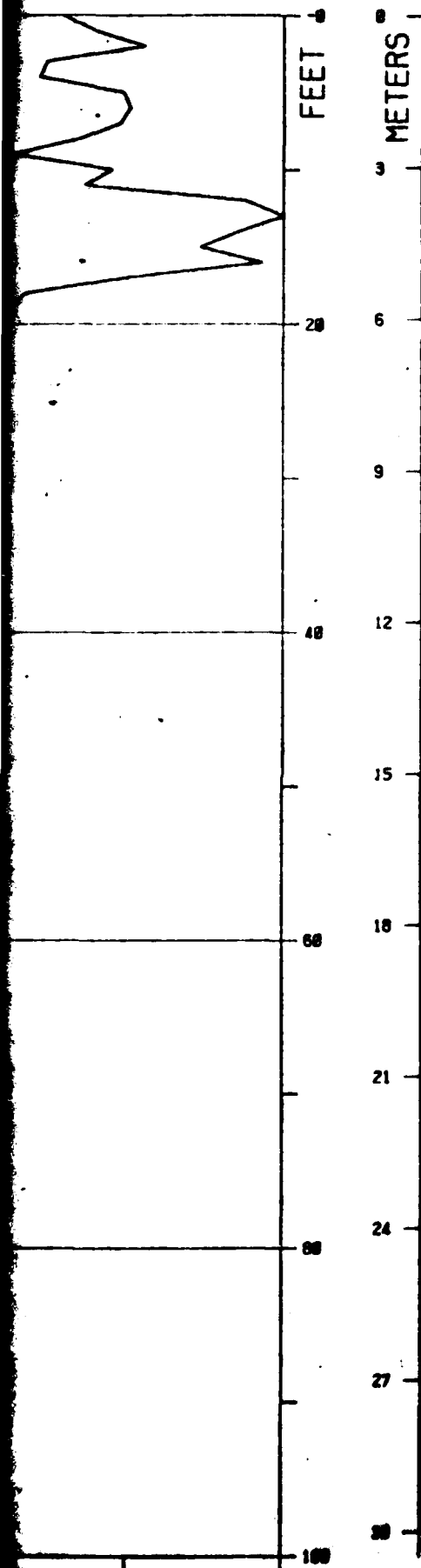
PROJECT NAME AIR FORCE
BORING NO. LD-8-13
ELEVATION 620' (189m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/26/77
TOTAL DEPTH LOGGED 81' (25m)
DEPTH TO WATER LEVEL
REMARKS

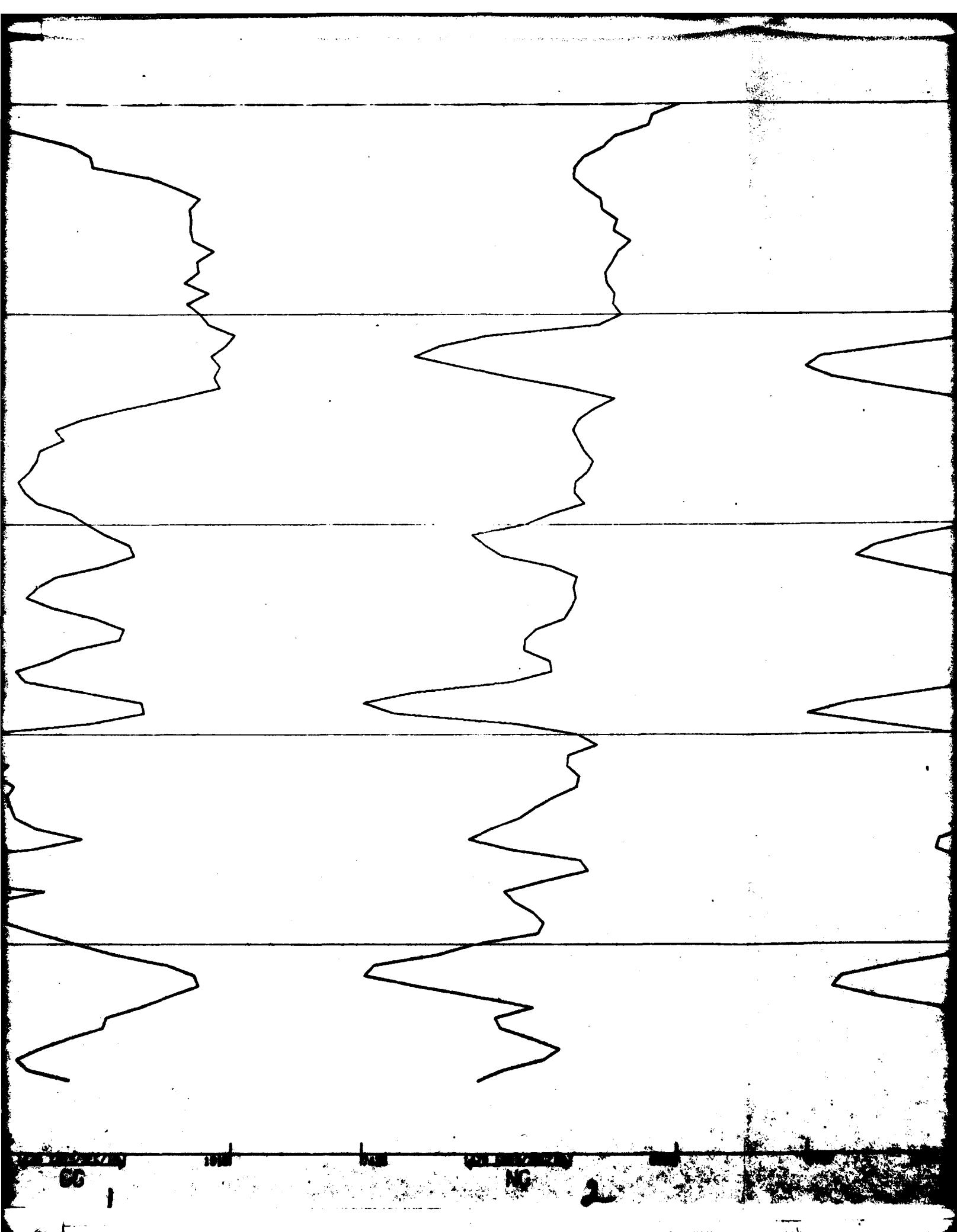
EXPLANATION

LOG TITLES

NATG - - - NATURAL GAMMA
GG - - - GAMMA GAMMA
NN - - - NEUTRON NEUTRON
NG - - - NEUTRON GAMMA
FT - - - FLUID TEMPERATURE
FR - - - FLUID RESISTIVITY
CALP - - - CALIPER
SP - - - SPONTANEOUS POTENTIAL
RES - - - RESISTIVITY
FMTA - - - FLOW METER
GA - - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
POROSITY (NN-LOG) INCREASES ←
WATER LEVEL - - - - -



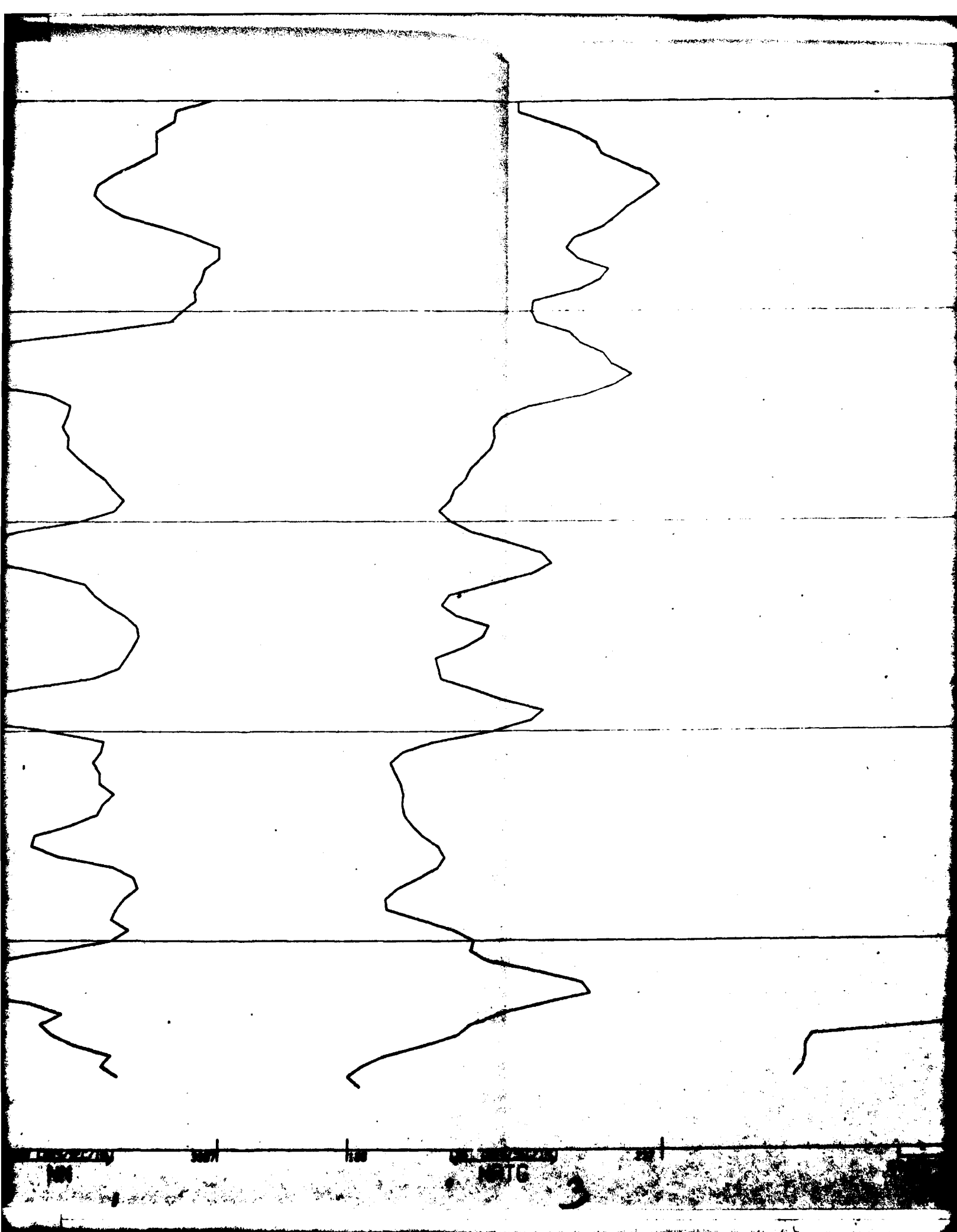


60

1

NG

2



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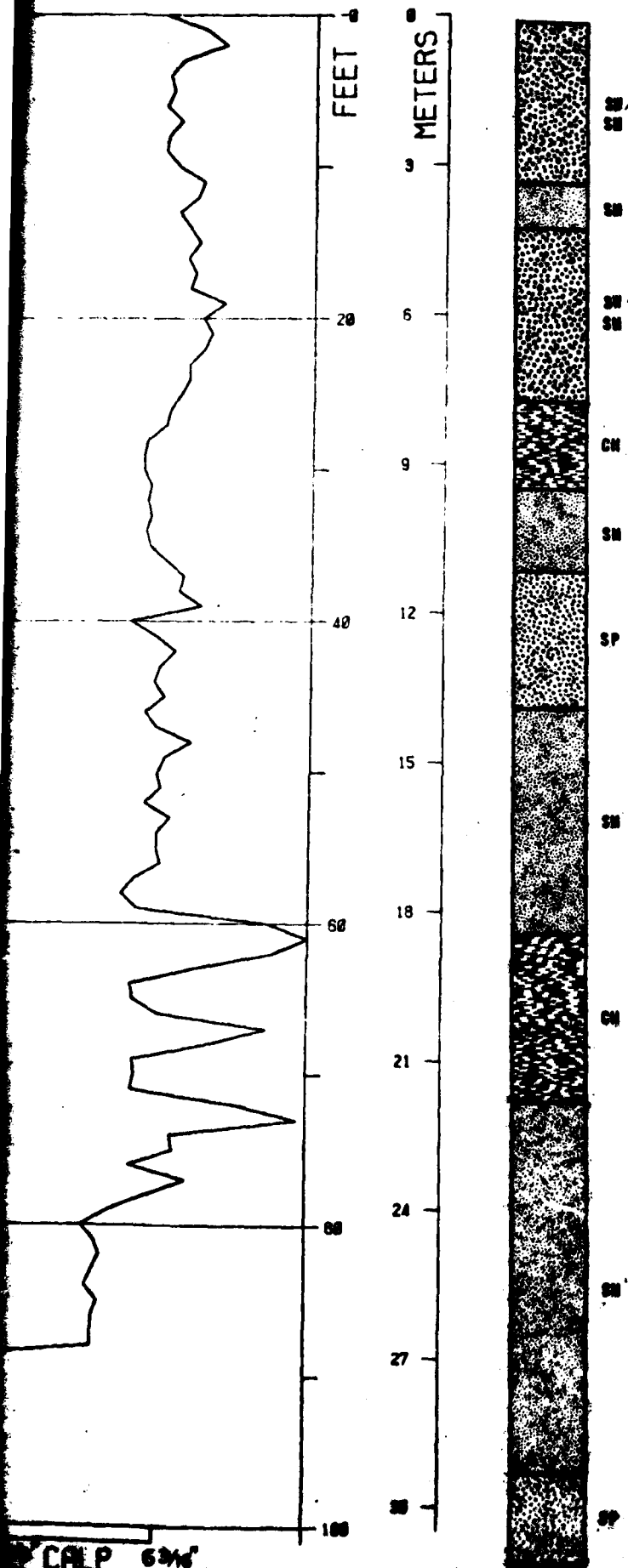
GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
 BORING NO. LD-B-14
 ELEVATION 420' (128m)
 STATE ARIZONA
 COUNTY YUMA
 STUDY AREA LECHUGUILLA DES.
 DATE LOGGED 5/26/77
 TOTAL DEPTH LOGGED 93' (28m)
 DEPTH TO WATER LEVEL —
 REMARKS —

LOG TITLES

NATG	---	NATURAL GAMMA
GG	---	GAMMA GAMMA
NN	---	NEUTRON NEUTRON
NG	---	NEUTRON GAMMA
FT	---	FLUID TEMPERATURE
FR	---	FLUID RESISTIVITY
CALP	---	CALIPER
SP	---	SPONTANEOUS POTENTIAL
WRES	---	RESISTIVITY
FMTR	---	FLOW METER
GH	---	DELTA GAMMA

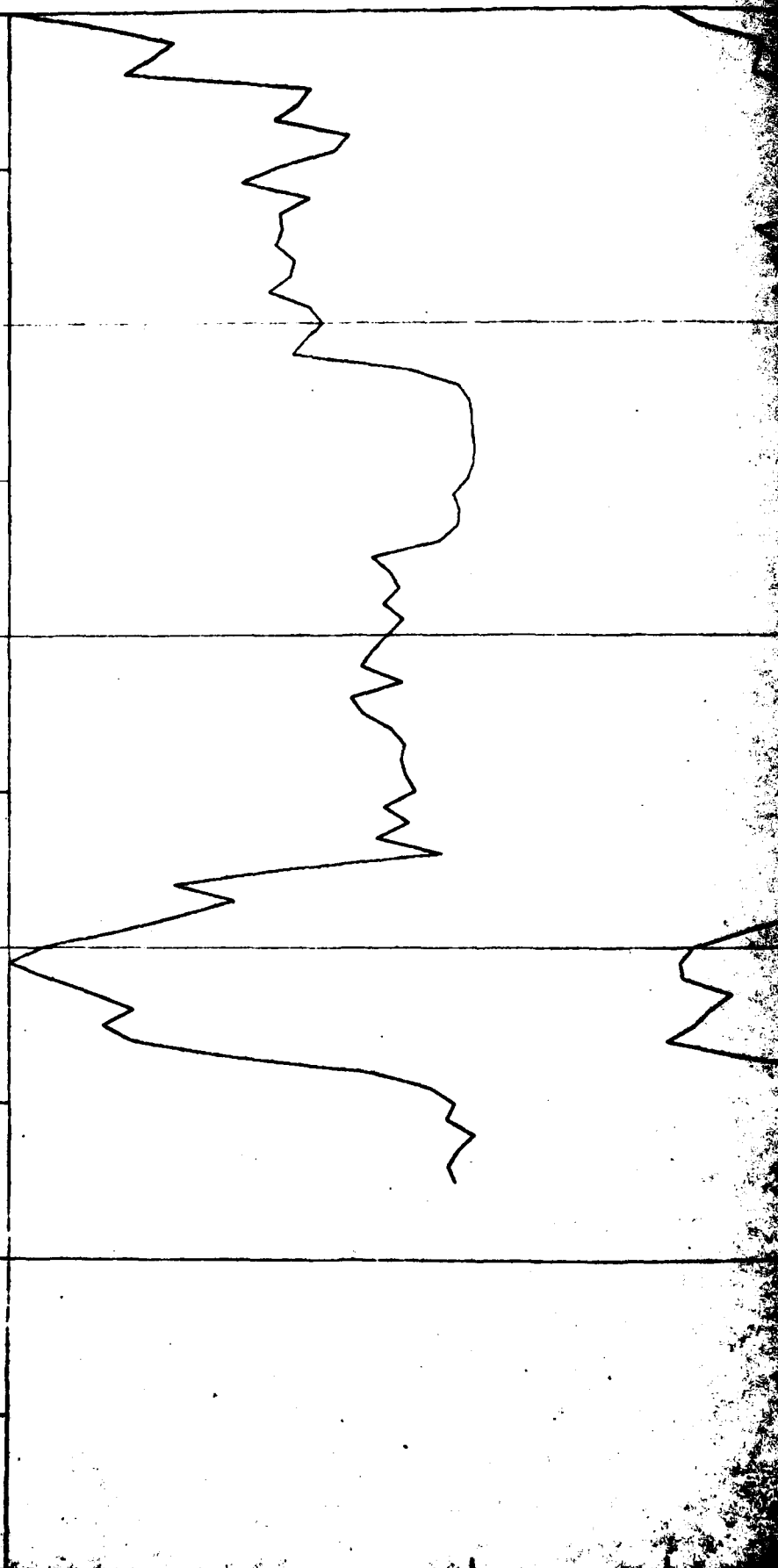
DENSITY (GG-LOG) INCREASES →
 POROSITY (NN-LOG) INCREASES ←
 WATER LEVEL -----



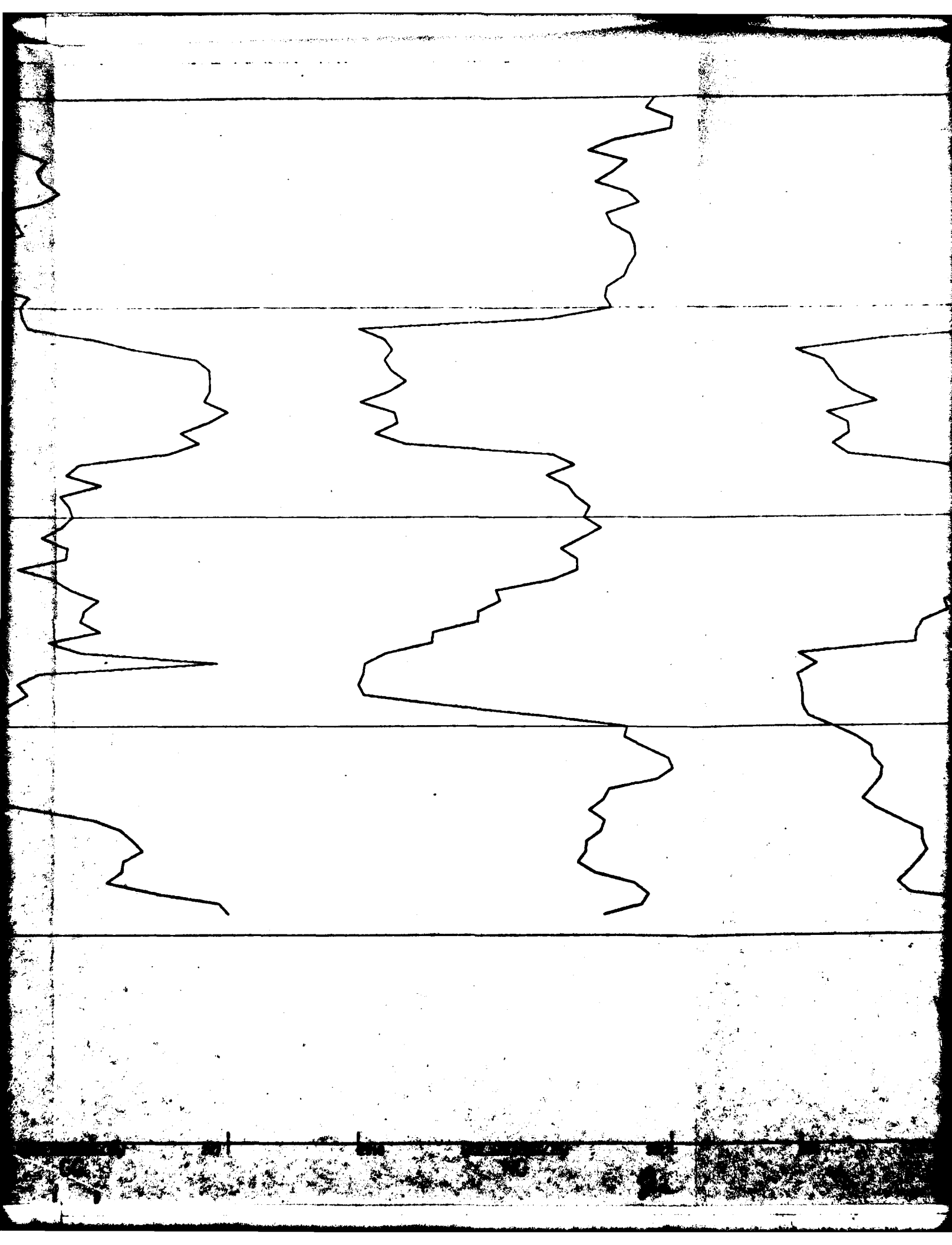


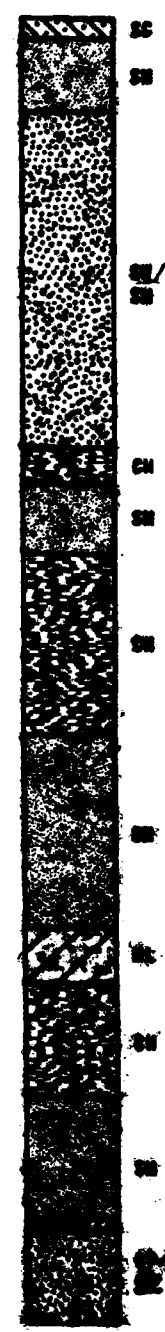
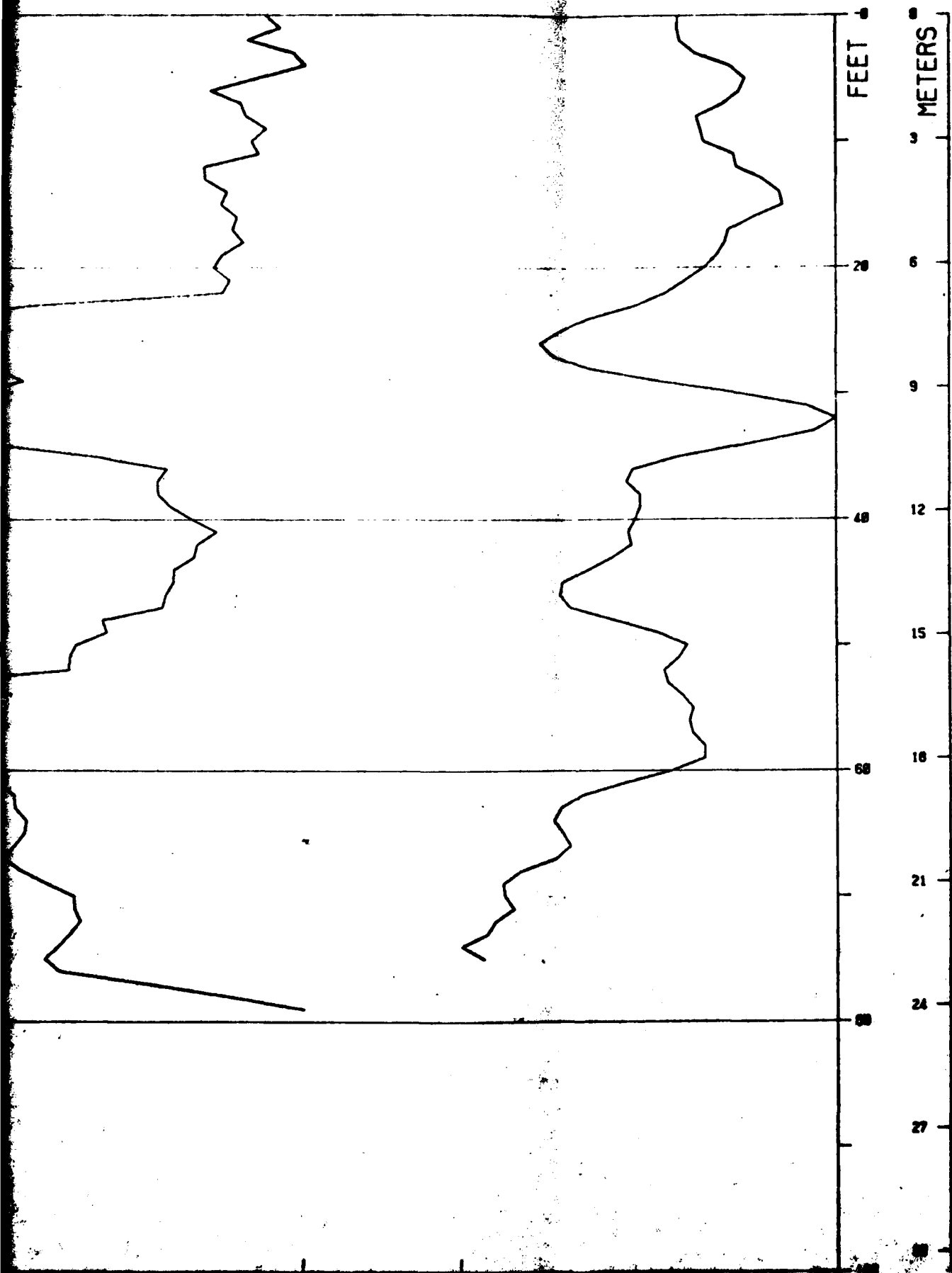
METERS

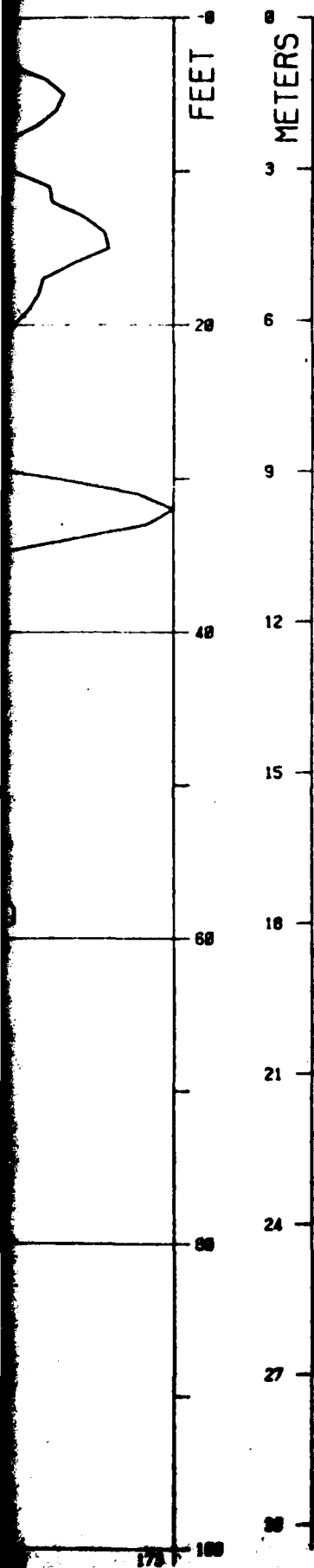
FEET



1 CM







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COLLEGE OF ENGINEERING

GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

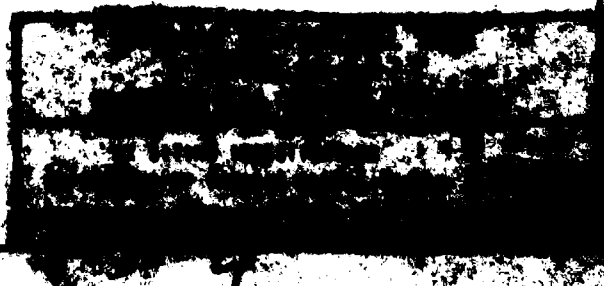
PROJECT NAME AIR FORCE
BORING NO. LD-8-17
ELEVATION 390' (119m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/16/77
TOTAL DEPTH LOGGED 41' (12m)
DEPTH TO WATER LEVEL . . .
REMARKS

EXPLANATION

LOG TITLES

NATG - - - NATURAL GAMMA
GG - - - GAMMA GAMMA
NN - - - NEUTRON NEUTRON
NG - - - NEUTRON GAMMA
FT - - - FLUID TEMPERATURE
FR - - - FLUID RESISTIVITY
CALP - - - CALIPER
SP - - - SPONTANEOUS POTENTIAL
WRES - - - RESISTIVITY
FMTR - - - FLOW METER
GR - - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
POROSITY (NN-LOG) INCREASES ←
WATER LEVEL - - - - -



LECHUGUILLA DES

DEPTH		P-WAVE VELOCITY		S-WAVE VELOCITY		UNIT WEIGHT	
(FT)	(M)	(FT/S)	(M/S)	(FT/S)	(M/S)	(PCF)	(KG/CM)

0 - 10	0 - 3	1175	358	660	190	116	1858
10 - 40	3 - 12	2300	701	900	274	116	1858
40 - 96	12 - 29	5000	1524	1960	597	116	1858
96 - 130	29 - 40	5000	1524	2500	762	150	2403

(INPUT)

LECHUGUILLA DES

DEPTH		P-WAVE VELOCITY		S-WAVE VELOCITY		UNIT WEIGHT	
(FT)	(M)	(FT/S)	(M/S)	(FT/S)	(M/S)	(PCF)	(KG/CM)

0 - 10	0 - 3	1680	512	940	287	116	1858
10 - 25	3 - 8	2250	686	1240	378	116	1858
25 - 40	8 - 12	2250	686	1240	378	106	1694
40 - 61	12 - 19	3950	1204	1240	378	106	1694
61 - 73	19 - 22	3950	1204	1240	378	116	1858
73 - 75	22 - 23	3950	1204	1240	378	150	2403

(INPUT)

1. S-WAVE VELOCITIES CALCULATED P
SEE SECTION 3.2.4

LA DESERT DOWNHOLE SURVEY B-1

UNIT DEPTH (KG/CM)	* POISSONS * RATIO	SHEAR MODULUS (KSF) (KN/SM)	YOUNGS MODULUS (KSF) (KN/SM)	BULK MODULUS (KSF) (KN/SM)
1858	.409	762 36463	2148 102788	3956 189292
1858	.410	2917 139578	8224 393499	15162 725467
1858	.409	13835 661980	38993 1865750	71588 3425355
2403	.333	29106 1392664	77616 3713770	77617 3713617
(CALCULATED)				

LLA DESERT DOWNHOLE SURVEY B-17

UNIT DEPTH (KG/CM)	* POISSONS * RATIO	SHEAR MODULUS (KSF) (KN/SM)	YOUNGS MODULUS (KSF) (KN/SM)	BULK MODULUS (KSF) (KN/SM)
1858	.272	3182 152261	8096 387391	5922 283343
1858	.282	5537 264958	14197 679295	10849 519097
1698	.282	5060 242116	12973 620735	9914 474347
1698	.445	5060 242116	14627 699881	44600 2134016
1858	.445	5537 264958	16007 765907	48807 2335338
2403	.445	7161 342618	20699 990397	63113 3019834
(CALCULATED)				

LCULATED FOR ALL DEPTHS

SUMMARY OF VELOCITY VALUES
AND DYNAMIC MODULI - PAGE 1 OF 6
LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SANSO

TABLE
A-1

FURRO NATIONAL INC.

LECHUGUILLA DESE

DEPTH		P-WAVE VELOCITY		S-WAVE VELOCITY		UNIT WEIGHT	
(FT)	(M)	(FT/S)	(M/S)	(FT/S)	(M/S)	(PCF)	(KG/CM)

0 - 10	0 - 3	1250	381	750	229	116	1858
10 - 40	3 - 12	2800	853	1900	579	116	1858
40 - 50	12 - 15	3600	1097	2600	792	116	1858
50 - 90	15 - 27	3500	1067	2500	762	117	1874
90 - 110	27 - 34	4760	1451	3400	1036	106	1698
110 - 230	34 - 70	4760	1451	3100	945	117	1874

(INPUT)

LECHUGUILLA DESE

DEPTH		P-WAVE VELOCITY		S-WAVE VELOCITY		UNIT WEIGHT	
(FT)	(M)	(FT/S)	(M/S)	(FT/S)	(M/S)	(PCF)	(KG/CM)

0 - 10	0 - 3	1600	488	900	274	116	1858
10 - 50	3 - 15	3100	945	1500	457	116	1858
50 - 160	15 - 49	5200	1585	1300	396	106	1698
160 - 200	49 - 61	5200	1585	1600	488	106	1698
200 - 250	61 - 76	6200	1889	1600	488	106	1698
250 - 300	76 - 91	5200	1585	1600	488	106	1698

(INPUT)

VILLA DESERT DOWNHOLE SURVEY C-1

DEPTH (FEET)	POTISSONS RATIO	SHEAR MODULUS (KSF)	YOUNGS MODULUS (KSF)	BULK MODULUS (KSF)
(KG/CM)		(KN/SM)	(KN/SM)	(KN/SM)
158	.219	2026	4938	2926
158	.427	3601	10278	23433
158	.277	14406	36786	27467
174	.277	14530	37103	27704
169	.453	6450	18740	65964
174	.132	34908	79012	35760
(CALCULATED)				

VILLA DESERT DOWNHOLE SURVEY C-2

DEPTH (FEET)	POTISSONS RATIO	SHEAR MODULUS (KSF)	YOUNGS MODULUS (KSF)	BULK MODULUS (KSF)
(KG/CM)		(KN/SM)	(KN/SM)	(KN/SM)
158	.269	2917	7401	5330
158	.393	6086	16960	26494
169	.467	5562	16314	81571
169	.448	8425	24393	77754
169	.472	8425	24796	145448
169	.448	8425	24393	77754
(CALCULATED)				

SUMMARY OF VELOCITY VALUES
AND DYNAMIC MODULI - PAGE 2 OF 6
LECHUGUILLA DESERT, ARIZONA

WIX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SANSO

TABLE
A-1

WERO NATIONAL INC.

LECHUGUILLA DESERT D

DEPTH		P-WAVE VELOCITY		S-WAVE VELOCITY		UNIT WEIGHT		* POT
(FT)	(M)	(FT/S)	(M/S)	(FT/S)	(M/S)	(PCF)	(KG/CM)	* PA

0 - 20	0 - 6	1350	411	800	244	116	1858	*
20 - 50	6 - 15	3700	1128	1800	549	116	1858	*
50 - 150	15 - 46	3700	1128	1800	549	117	1874	*
150 - 210	46 - 64	5700	1737	2800	853	117	1874	*
210 - 250	64 - 76	5700	1737	1800	549	117	1874	*
250 - 300	76 - 91	4600	1402	1800	549	106	1698	*

(INPUT)

LECHUGUILLA DESERT D

DEPTH		P-WAVE VELOCITY		S-WAVE VELOCITY		UNIT WEIGHT		* PD
(FT)	(M)	(FT/S)	(M/S)	(FT/S)	(M/S)	(PCF)	(KG/CM)	* R

0 - 20	0 - 6	1500	457	780	238	116	1858	*
20 - 90	6 - 27	3900	1189	2200	671	117	1874	*
90 - 130	27 - 40	6700	2042	2200	671	117	1874	*
130 - 200	40 - 61	3900	1189	2200	671	117	1874	*
200 - 250	61 - 76	5700	1737	2200	671	117	1874	*

(INPUT)

LLA DESERT DOWNHOLE SURVEY C-3

DEPTH (FT)	POISSONS RATIO	SHEAR MODULUS		YOUNGS MODULUS		BULK MODULUS	
		(KSF)	(KN/SM)	(KSF)	(KN/SM)	(KSF)	(KN/SM)
1858	.229	2305	110284	5667	271164	3490	167009
1858	.345	11668	558313	31388	1501836	33745	1614647
1874	.345	11769	563126	31658	1514783	34036	1628566
1874	.341	28478	1362627	76377	3654493	80048	3830116
1874	.445	11769	563126	34004	1627002	102326	4896090
1698	.410	10663	510183	30060	1438306	55419	2651708
(CALCULATED)							

LLA DESERT DOWNHOLE SURVEY C-4

DEPTH (FT)	POISSONS RATIO	SHEAR MODULUS		YOUNGS MODULUS		BULK MODULUS	
		(KSF)	(KN/SM)	(KSF)	(KN/SM)	(KSF)	(KN/SM)
1858	.315	2191	104839	5761	275662	5182	247936
1874	.267	17581	841214	44537	2131020	31809	1521976
1874	.440	17581	841214	50618	2421981	139619	6680492
1874	.267	17581	841214	44537	2131020	31809	1521976
1874	.412	17581	841214	49665	2376390	94577	4525317
(CALCULATED)							

SUMMARY OF VELOCITY VALUES
AND DYNAMIC MODULI - PAGE 3 OF 8
LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE
A-1

2

FURRO NATIONAL INC.

LECHUGUILLA DESERT

DEPTH		P-WAVE VELOCITY		S-WAVE VELOCITY		UNIT WEIGHT		
(FT)	(M)	(FT/S)	(M/S)	(FT/S)	(M/S)	(PCF)	(KG/CM)	*

0 - 20	0 - 6	1700	518	1000	274	116	1858	*
20 - 60	6 - 18	3800	1158	1800	509	116	1858	*
60 - 215	18 - 66	4800	1463	2800	693	117	1874	*
215 - 255	66 - 78	6200	1890	3300	1006	117	1874	*
255 - 270	78 - 82	6200	1890	3300	1006	150	2403	*

(DEPTH)								

LECHUGUILLA DESERT

DEPTH		P-WAVE VELOCITY		S-WAVE VELOCITY		UNIT WEIGHT		
(FT)	(M)	(FT/S)	(M/S)	(FT/S)	(M/S)	(PCF)	(KG/CM)	*

0 - 15	0 - 5	1500	457	600	183	116	1858	*
15 - 50	5 - 15	4600	1402	2100	640	116	1858	*
50 - 155	15 - 47	4600	1402	2100	640	117	1874	*
155 - 270	47 - 82	6800	2073	2100	640	117	1874	*
270 - 370	82 - 113	6700	2042	3500	1067	117	1874	*

(DEPTH)								

LA DESERT DOWNHOLE SURVEY C-5

DEPTH (KG/CM)	★ POISSONS ★ RATIO	SHEAR MODULUS		YOUNGS MODULUS		BULK MODULUS	
		(KSF)	(KN/SM)	(KSF)	(KN/SM)	(KSF)	(KN/SM)
1458	.305	2917	139578	7615	364380	6519	311902
1458	.355	11668	558313	31630	1513428	36446	1743886
1474	.242	28478	1362627	70746	3385052	45721	2187664
1474	.502	39557	1892730	103035	4930030	86889	4157466
2403	.302	50714	2426577	132096	6320552	111396	5330084
(CALCULATED)							

LLA DESERT DOWNHOLE SURVEY C-6

DEPTH (KG/CM)	★ POISSONS ★ RATIO	SHEAR MODULUS		YOUNGS MODULUS		BULK MODULUS	
		(KSF)	(KN/SM)	(KSF)	(KN/SM)	(KSF)	(KN/SM)
1458	.405	1296	62035	3643	174288	6374	305007
1458	.368	15882	759927	43465	2079703	55030	2633059
1474	.368	16019	766478	43839	2097632	55504	2655758
1474	.447	16019	766478	46368	2218626	146605	7014773
1474	.312	44497	2129104	116792	5588247	103732	4963347
(CALCULATED)							

SUMMARY OF VELOCITY VALUES
AND DYNAMIC MODULI - PAGE 4 OF 8
LECHUGUILLA DESERT, ARIZONA

ON SITE INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SANDO

TABLE
A-1

INTERNATIONAL INC.

LECHUGUILLA DESERT

DEPTH		P-WAVE VELOCITY		S-WAVE VELOCITY		UNIT WEIGHT	
(FT)	(M)	(FT/S)	(M/S)	(FT/S)	(M/S)	(PCF)	(KG/CM)

0 - 25	0 - 8	1675	511	1000	305	116	1858
25 - 65	8 - 20	3300	1006	1400	427	116	1858
65 - 275	20 - 80	5300	1615	2200	671	117	1874
275 - 450	84 - 137	5300	1615	2200	671	106	1698
450 - 490	137 - 140	5300	1615	2750	838	106	1698

(INFEUT)

LECHUGUILLA DESERT

DEPTH		P-WAVE VELOCITY		S-WAVE VELOCITY		UNIT WEIGHT	
(FT)	(M)	(FT/S)	(M/S)	(FT/S)	(M/S)	(PCF)	(KG/CM)

0 - 20	0 - 6	1650	504	1000	305	116	1858
20 - 300	6 - 91	4900	1494	2300	701	117	1874
300 - 400	91 - 122	4900	1494	2700	823	117	1874
400 - 450	122 - 137	9200	2804	2700	823	117	1874
450 - 470	137 - 143	4900	1494	2700	823	117	1874

(INFEUT)

LECHUGUILLA DESERT DOWNHOLE SURVEY D=1

UNIT DEPTH	* *	POTISSONS RATIO	SHEAR MODULUS	YOUNGS MODULUS	BULK MODULUS
(KG/CM)	*		(KSF) (KN/SM)	(KSF) (KN/SM)	(KSF) (KN/SM)

6	1858	.223	3601 172319	8810 421522	5302 253709
6	1858	.390	7059 337745	19627 939105	29808 1426238
7	1874	.396	17581 841214	49083 2348523	78594 3760577
6	1698	.396	15928 762125	44468 2127722	71205 3407018
6	1698	.316	24888 1190820	65494 3133753	59259 2835439
			(CALCULATED)		

LECHUGUILLA DESERT DOWNHOLE SURVEY D=2

UNIT DEPTH	* *	POTISSONS RATIO	SHEAR MODULUS	YOUNGS MODULUS	BULK MODULUS
(KG/CM)	*		(KSF) (KN/SM)	(KSF) (KN/SM)	(KSF) (KN/SM)

6	1858	.210	3601 172319	8713 416917	5003 239385
7	1874	.359	19216 919426	52217 2498460	61595 2947175
7	1874	.282	26480 1267034	67896 3248670	51908 2483708
7	1874	.453	26480 1267034	76946 3681689	272142 13021450
7	1874	.282	26480 1267034	67896 3248670	51908 2483708
			(CALCULATED)		

2

LECHUGUILLA DESO

DEPTH		P-WAVE VELOCITY		S-WAVE VELOCITY		UNIT WEIGHT	
(FT)	(M)	(FT/S)	(M/S)	(FT/S)	(M/S)	(PCF)	(KG/CM)

0 - 20	0 - 6	1800	549	990	274	116	1858
20 - 50	6 - 15	5100	1554	2100	640	116	1858
50 - 150	15 - 46	5100	1554	2100	640	117	1874
150 - 480	46 - 146	5100	1554	2010 ¹	613	117	1874

(INPUT)

1. S-WAVE VELOCITY CALCULATED
SEE SECTION 3.2.4

LECHUGUILLA DESERT DOWNHOLE SURVEY D-3

DEPTH (FT)	* POISSONS * RATIO	SHEAR MODULUS (KSF)	(KN/SM)	YOUNGS MODULUS (KSF)	(KN/SM)	BULK MODULUS (KSF)	(KN/SM)
1858	.333	2017	139578	7779	372209	7779	372214
1858	.398	15882	759927	44404	2124628	72496	3468806
1870	.398	16019	766478	44786	2142944	73121	3498709
1874	.408	14675	702187	41327	1977435	74913	3584427
(CALCULATED)							

LATED

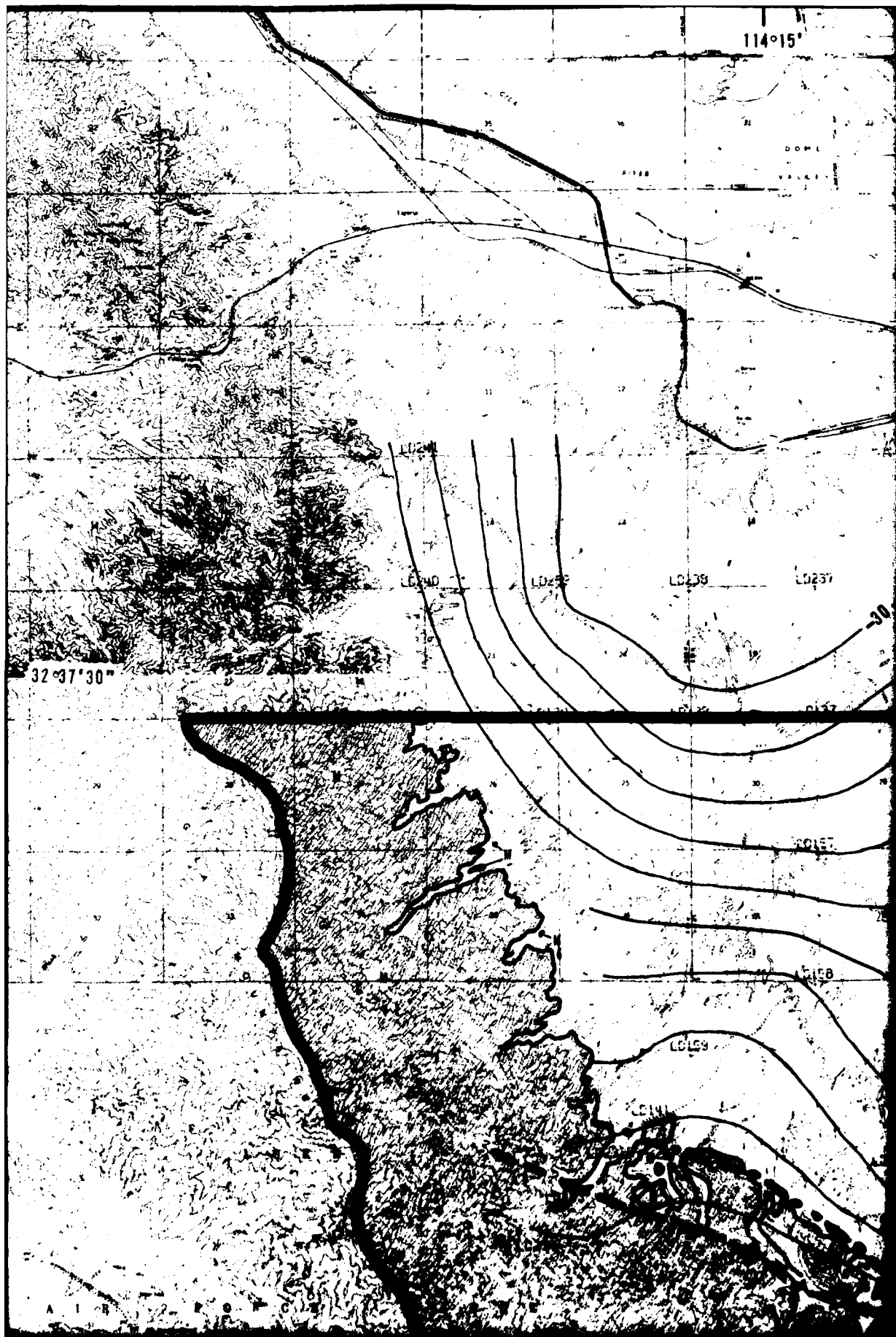
SUMMARY OF VELOCITY VALUES
AND DYNAMIC MODULI - PAGE 8 OF 8
LECHUGUILLA DESERT, ARIZONA

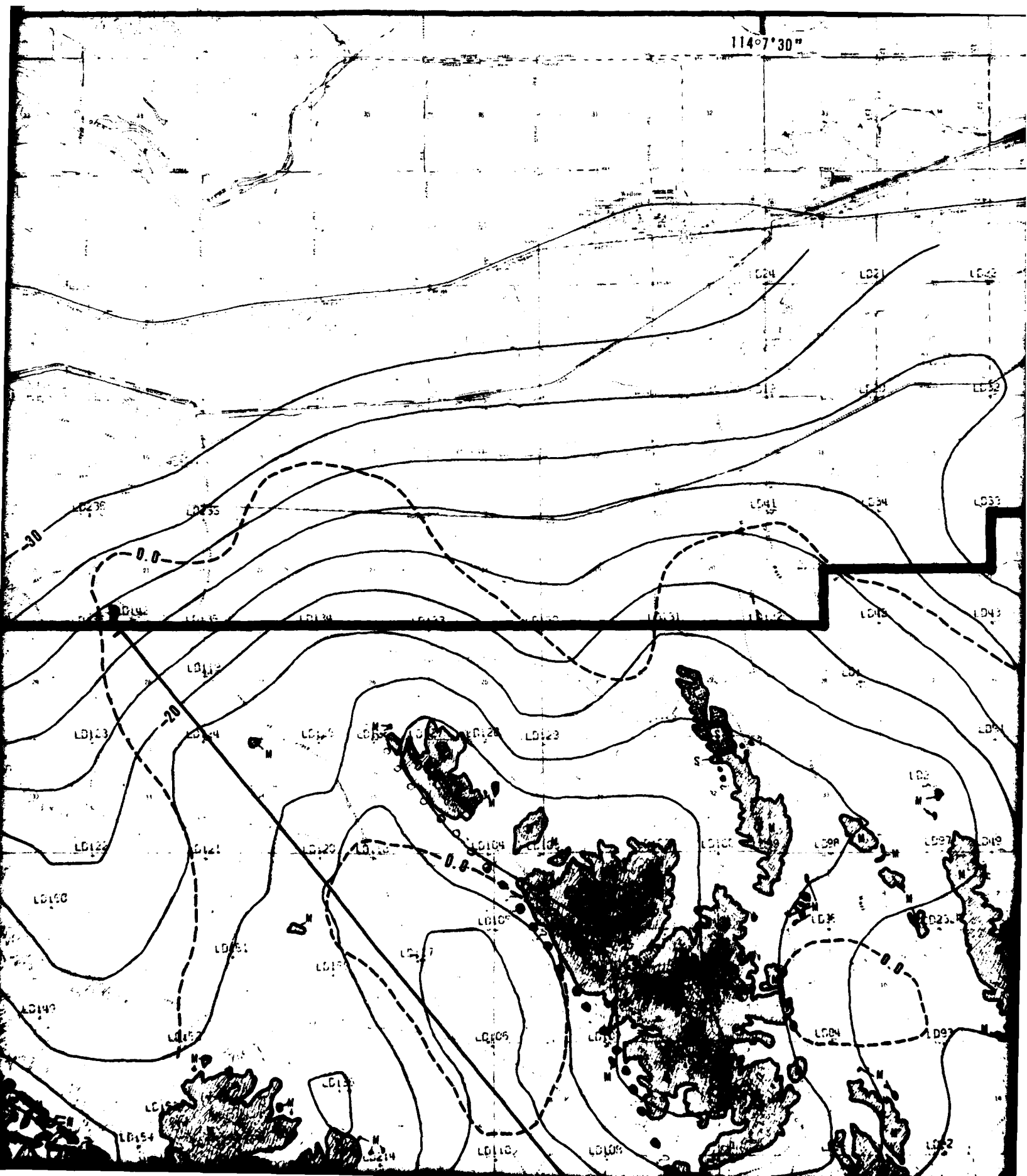
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAUSO

TABLE
A-1

FUERO NATIONAL INC.

2

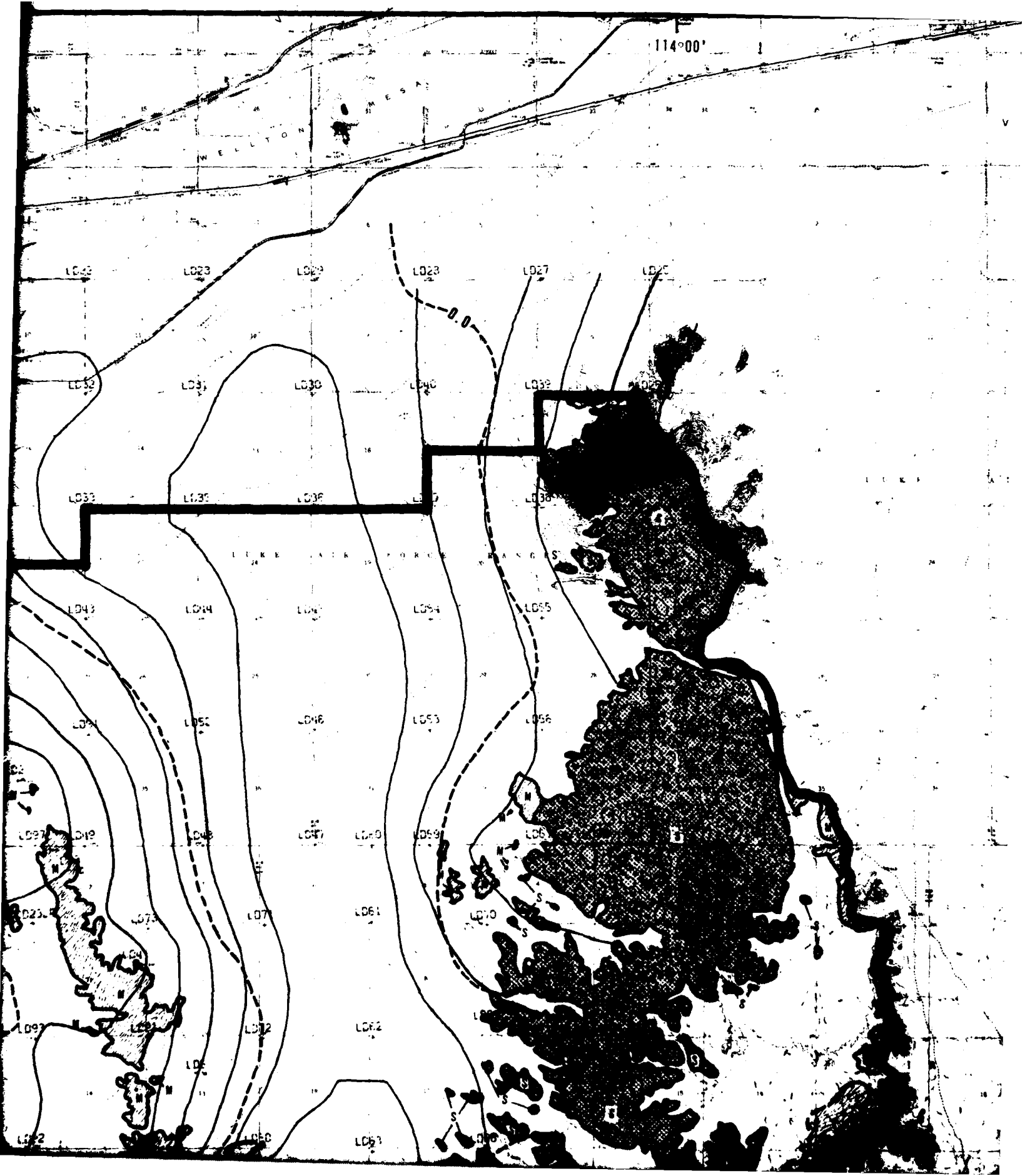




114°00'

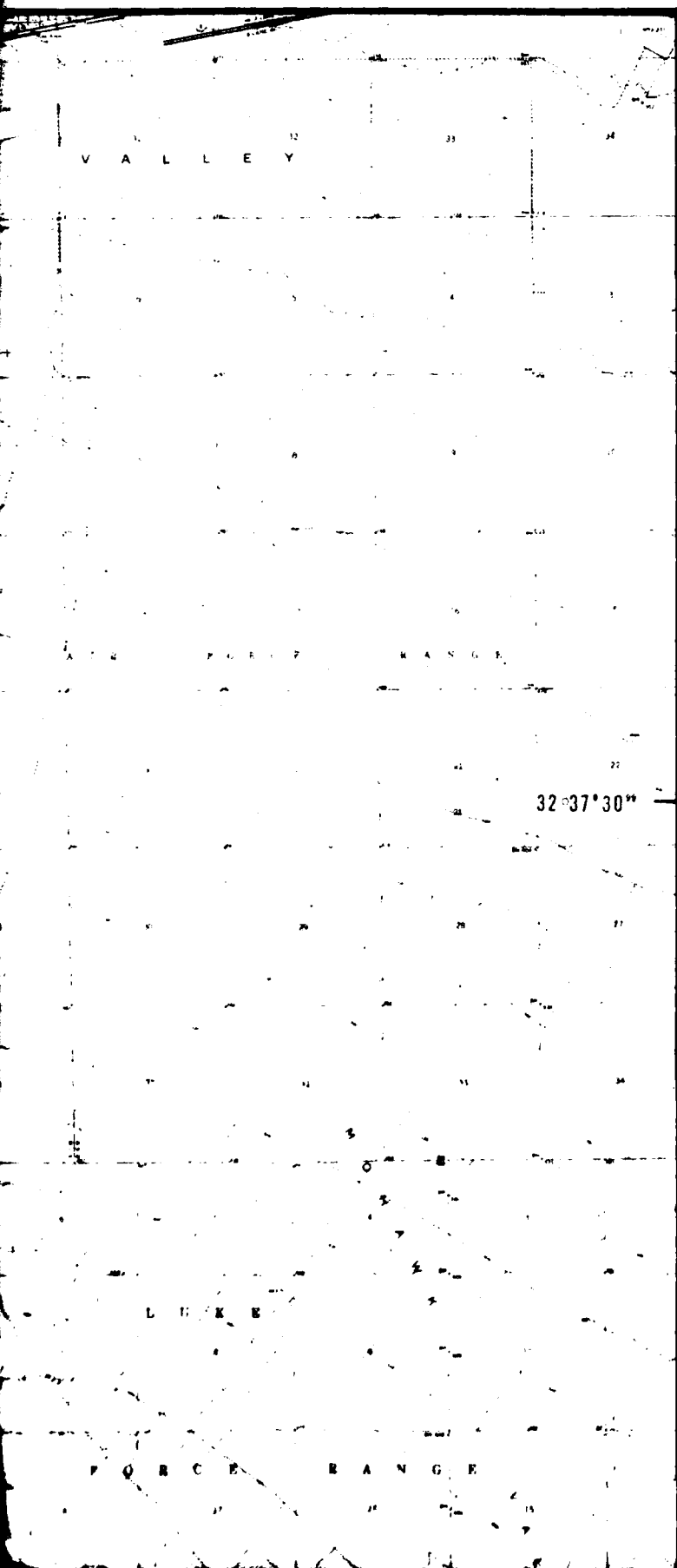
WELLTON

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5

EXPLANATION

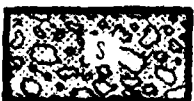
ROCK UNITS



Igneous; Intrusive (I1); predominantly fine to coarse grained quartz monzonite.
Igneous; Extrusive (I2); predominantly basalt.



Metamorphic (M); metamorphic complexes of gneiss and schist; mineral compositions of quartz, feldspar, biotite, muscovite, amphibole, and epidote.



Sedimentary (S); predominantly arkosic sandstone and granite-gneiss boulder conglomerate (massively to indistinctly bedded); cobble and boulder clasts in conglomerate are predominantly biotite-quartz monzonite, schist, and gneiss.

SURFICIAL BASIN-FILL UNITS



Undifferentiated Alluvium

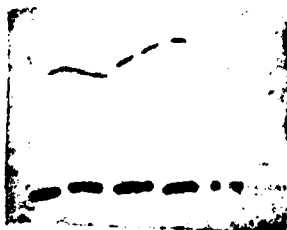
SYMBOLS



GRAVITY CONTOUR; Contour interval 2 milligals.

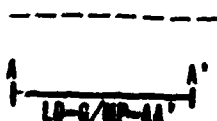
LD42
+

GRAVITY STATIONS



GEOLOGIC CONTACT; Rock/basin fill where line is solid, rock and colluvium/basin fill where line is dashed. (Colluvium cannot be illustrated at presentation scale due to limited extent).

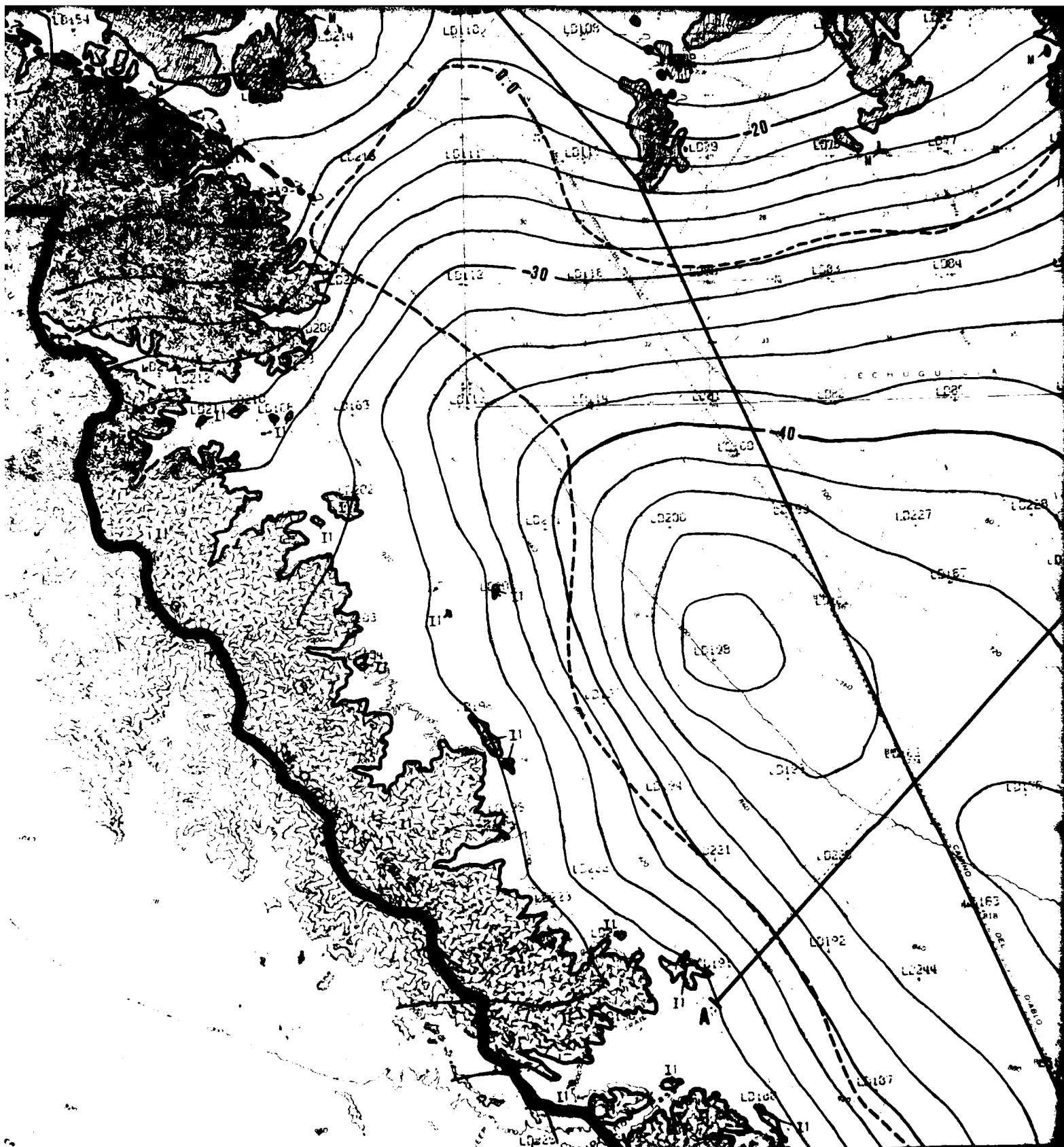
FAULT; Approximately located, dotted where concealed by surficial deposits, queried where existence uncertain.

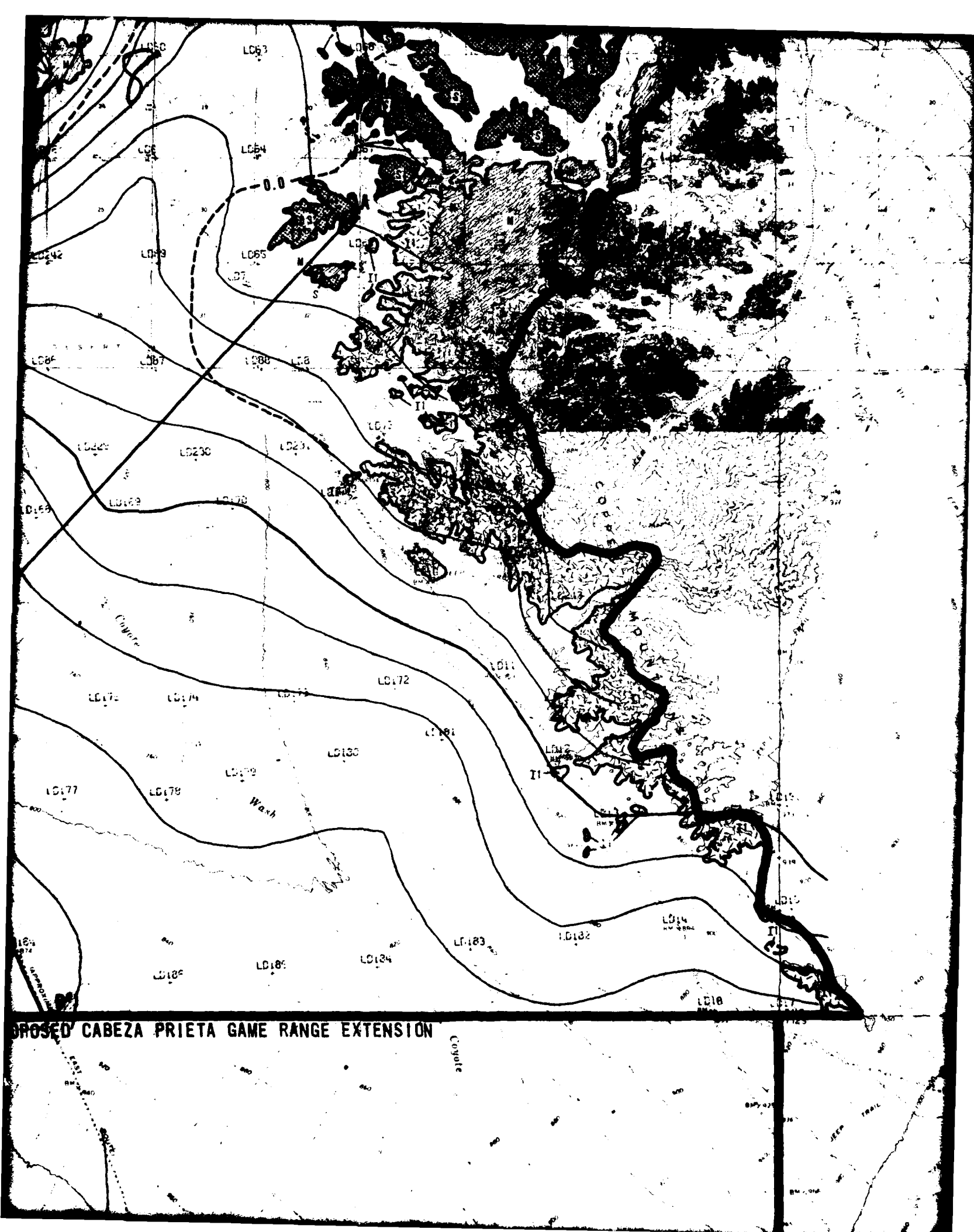


Second vertical derivative (zero value) of bouguer anomaly.

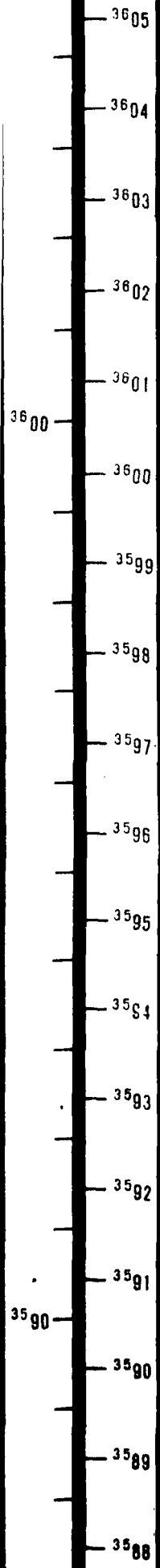
Line of Gravity/Magnetic Profile



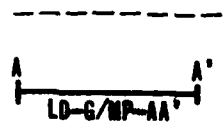
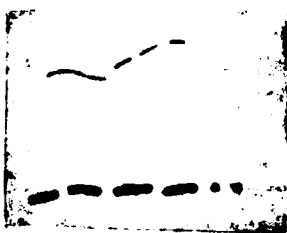




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GRAVITY CONTOUR; Conto

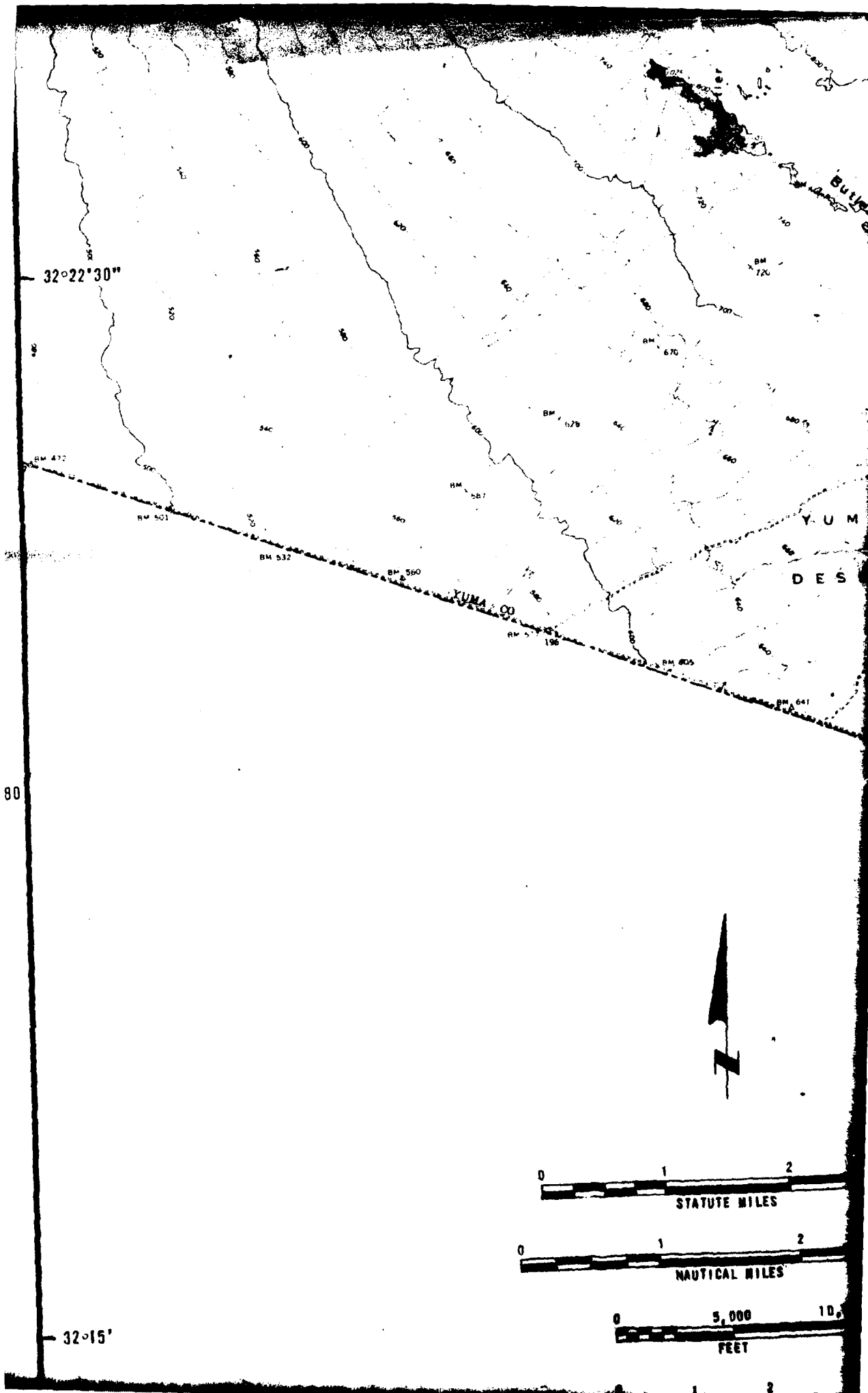
GRAVITY STATIONS

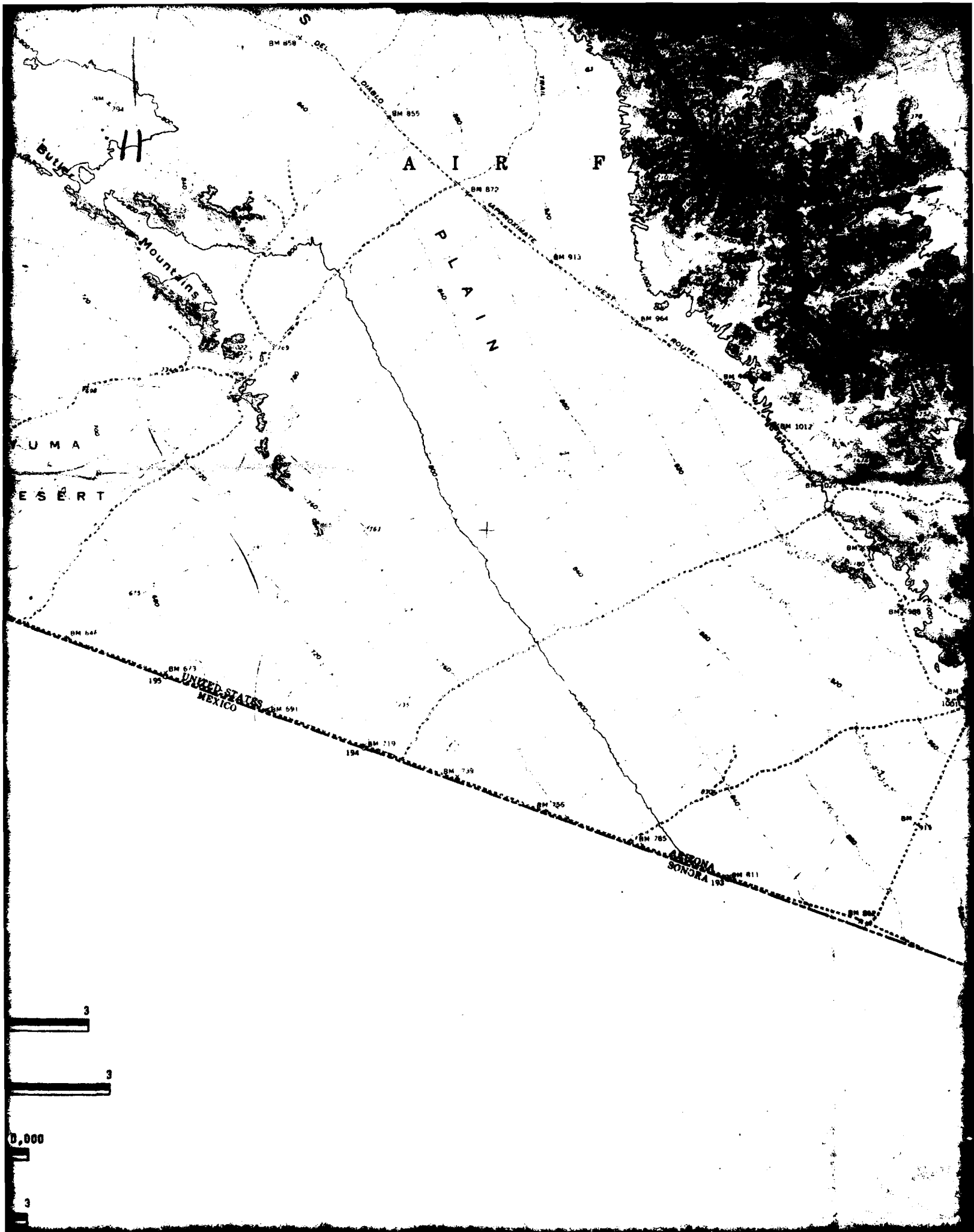
GEOLOGIC CONTACT; Rock
where line is dashed.
limited extent).

FAULT; Approximately
queried where ex

Second vertical deriva

Line of Gravity/Magn





12

TECHNICAL

Wash

CONFIDENTIAL

**Coyote
Water**

Wash.

Week

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• **Figure 10-10**

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DIABETES

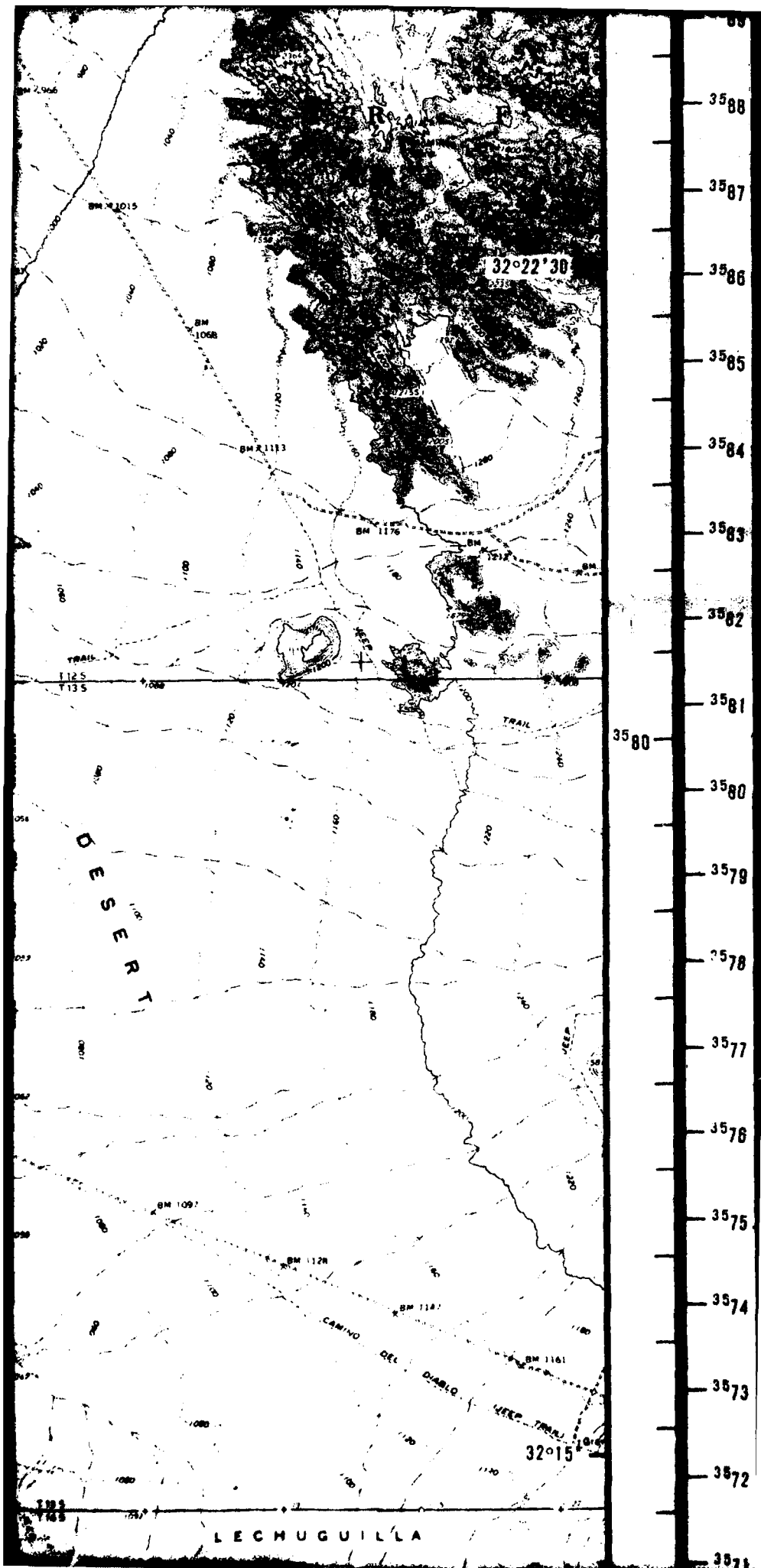
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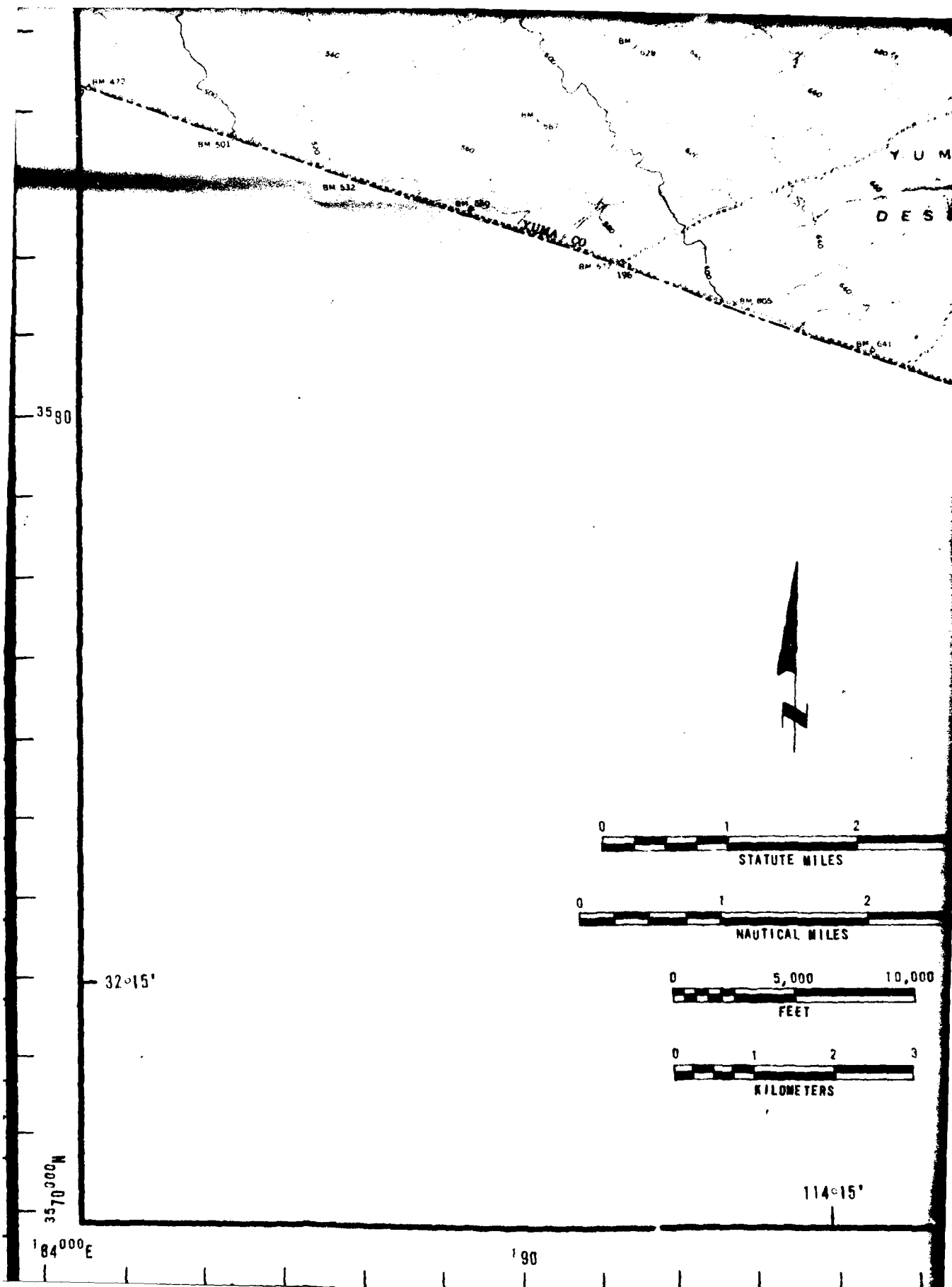
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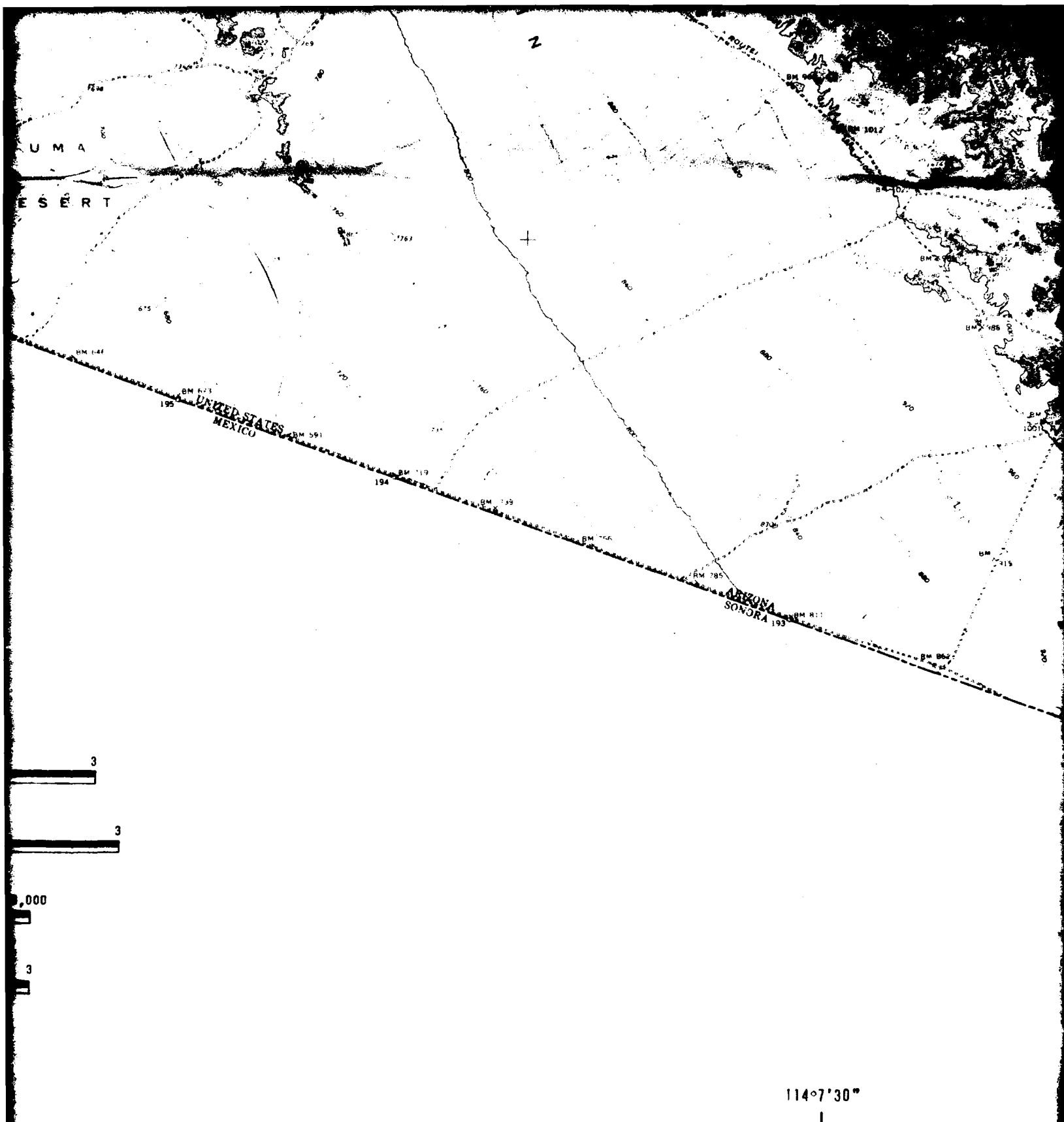
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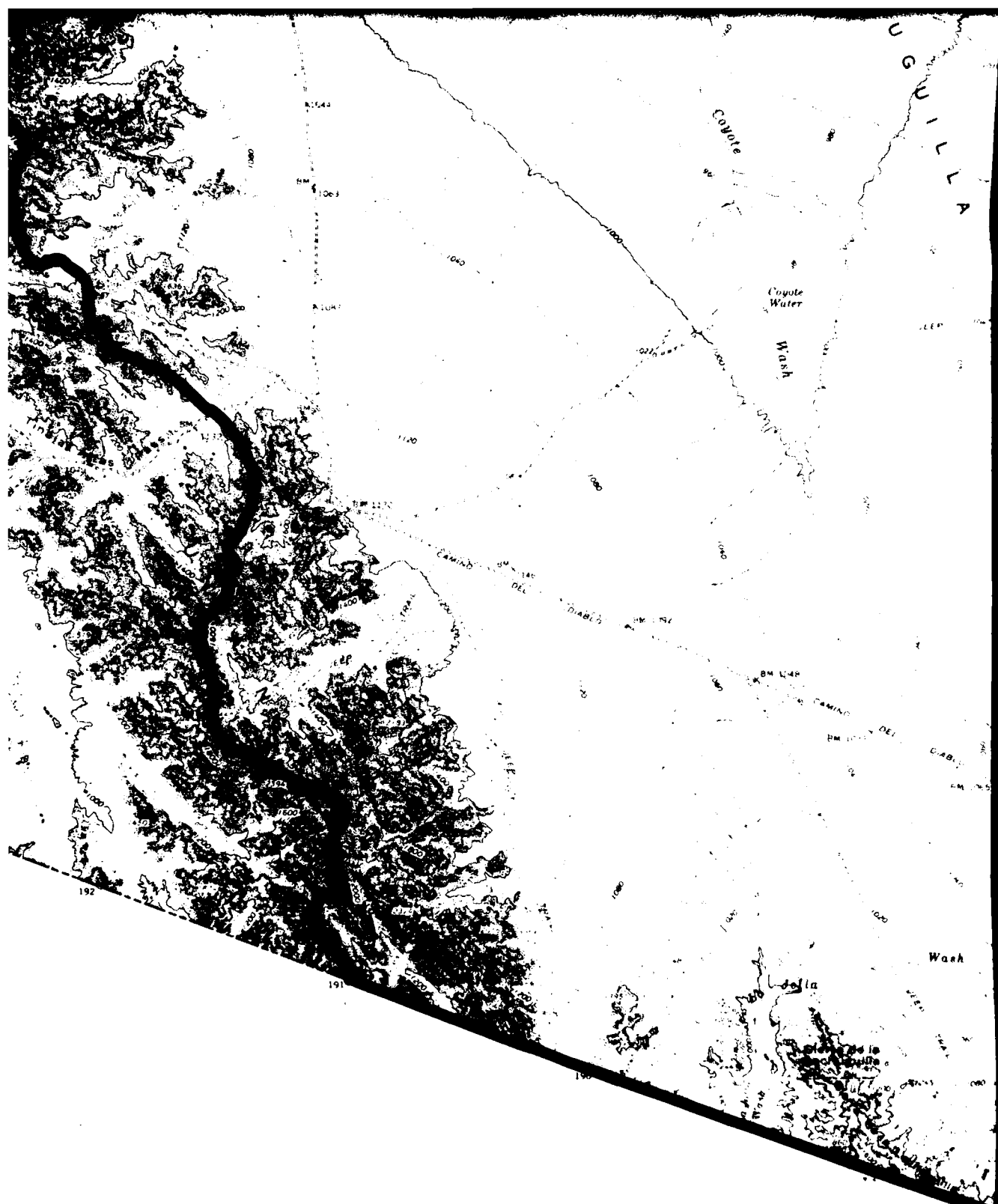
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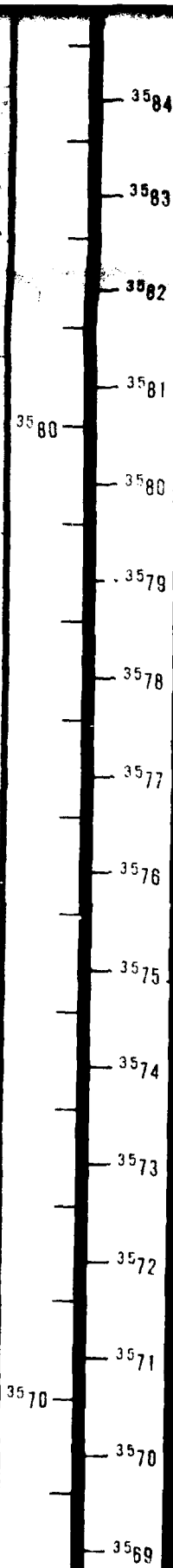
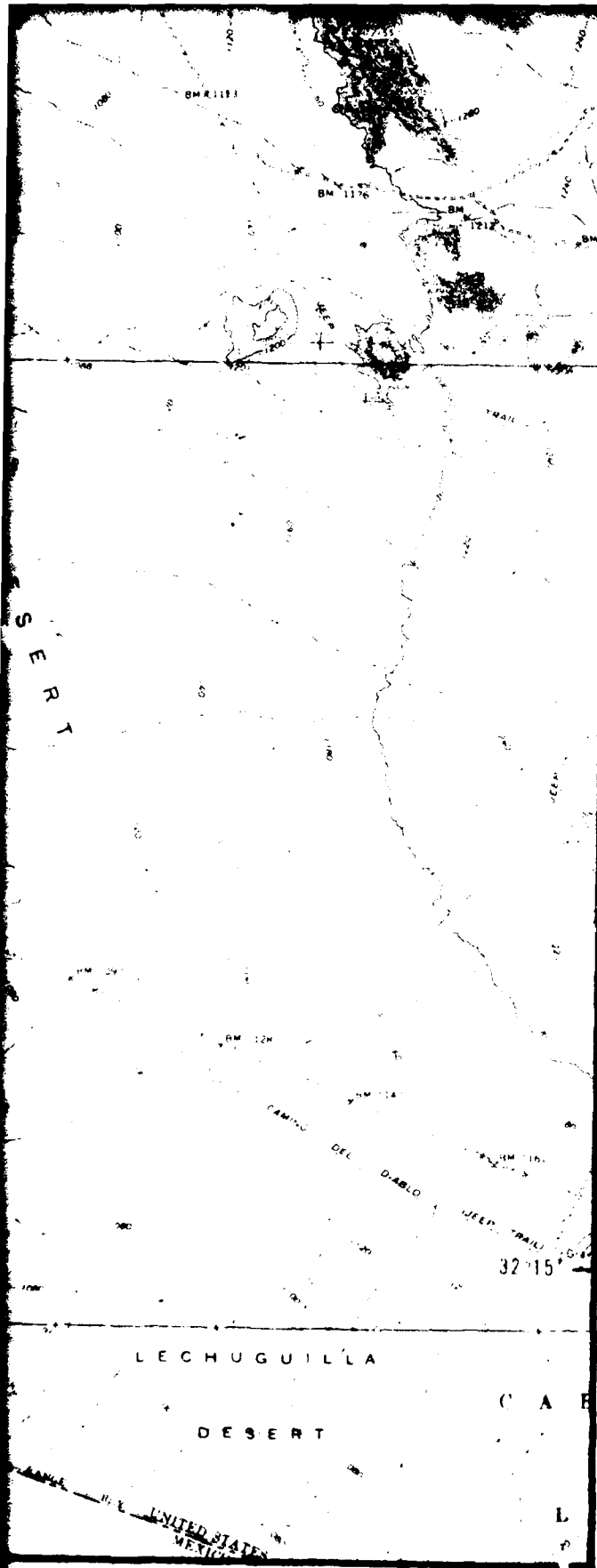
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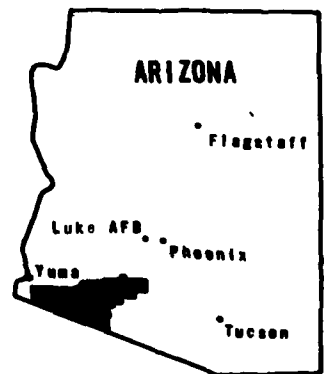
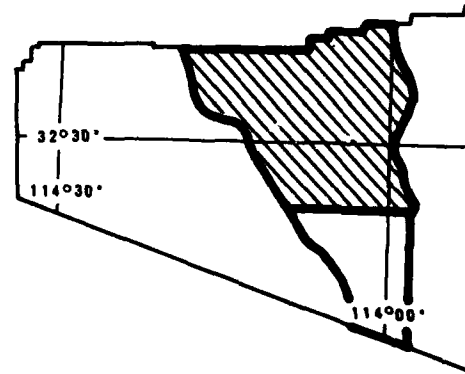








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FUGRO NATIONAL INC LONG BEACH CA

F/S 8/7

MX SITING INVESTIGATION. GEOTECHNICAL EVALUATION OF LUKE BOMBIN-ETC(U)

JAN 78

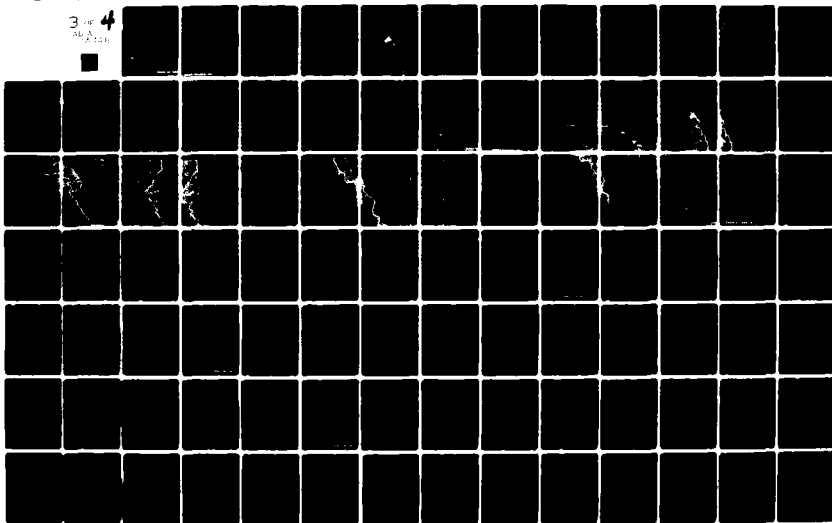
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NL

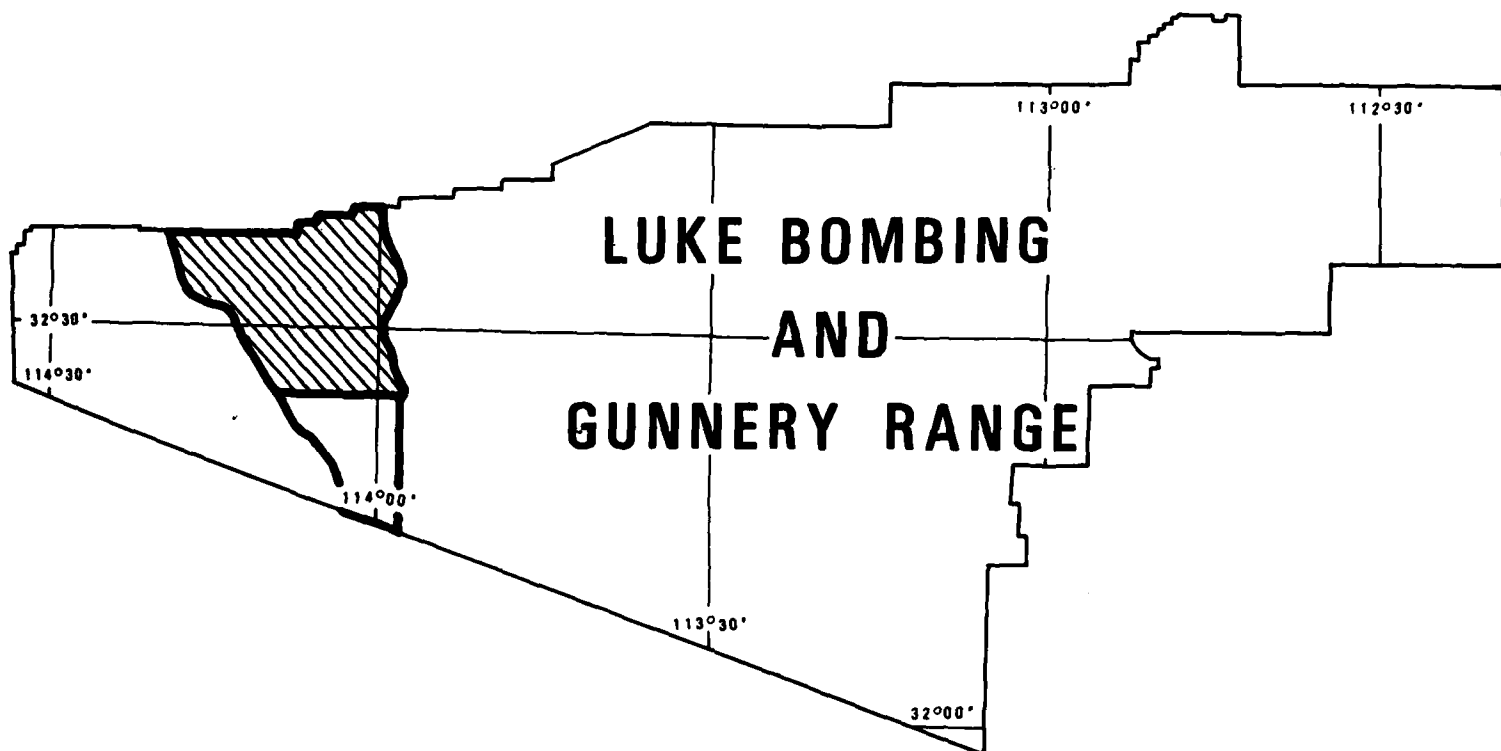
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FN-TR-190-VOL-2-APP-A

3 of 4
PAGE 1



A
B 44



**BOUGER GRAVITY
LECHUGUILLA DESERT, ARIZONA**

**MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAN**

FURRO NATIONAL

113°00'

112°30'

MBING

RANGE

32°00'

BOUGER GRAVITY
LECHUGUILLA DESERT, ARIZONA

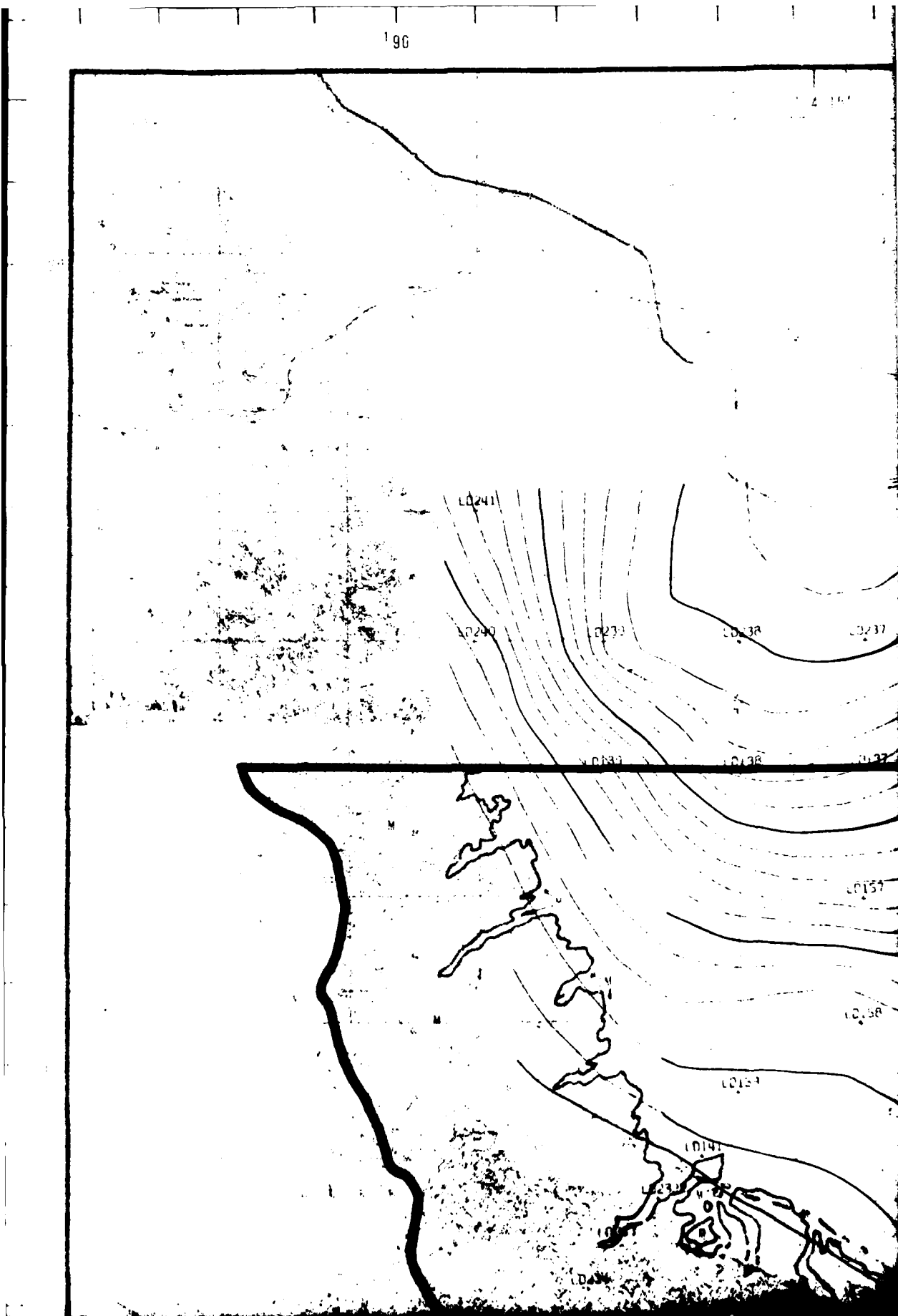
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

DRAWING

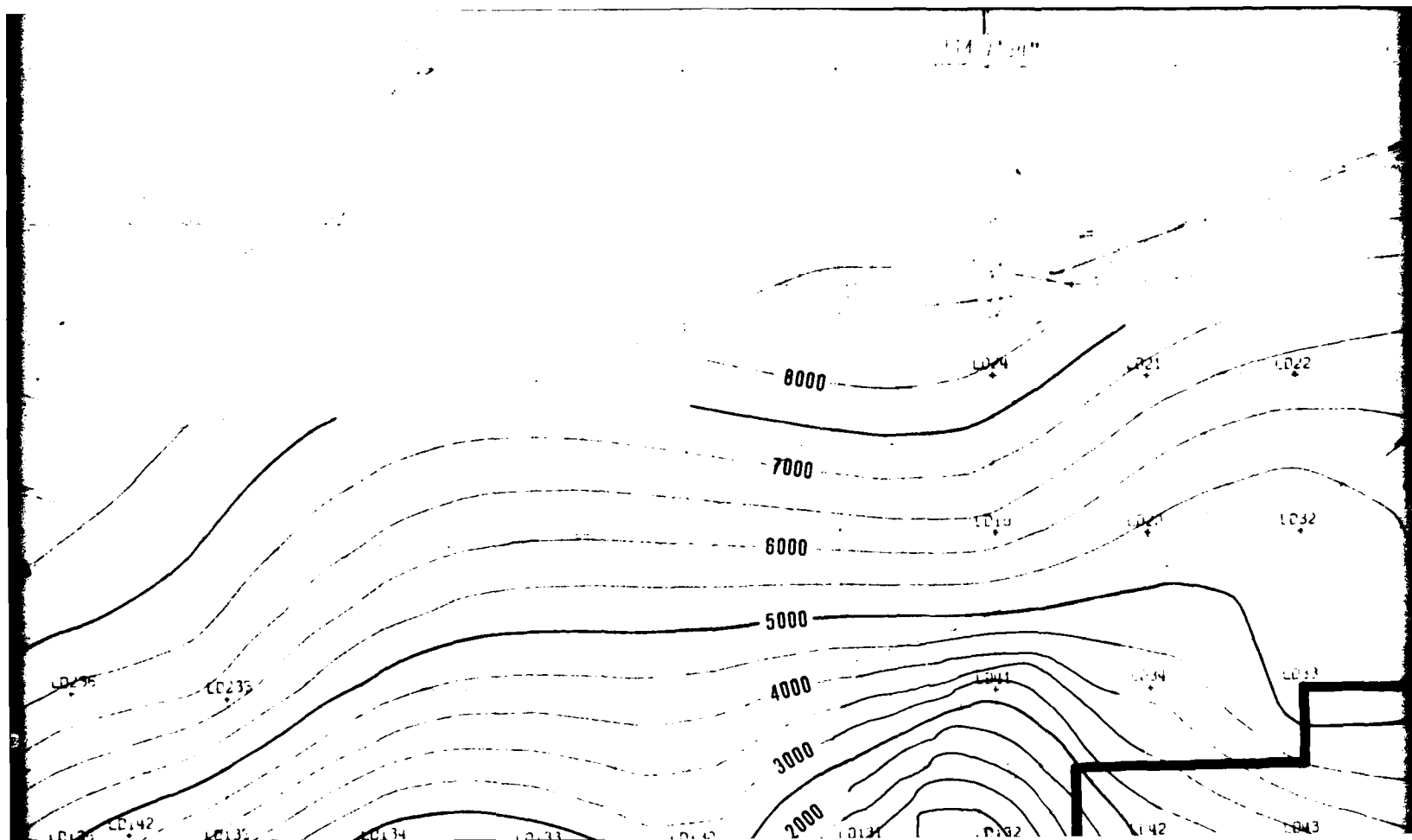
A-1

FUBRO NATIONAL, INC.

19



114 2' 50"





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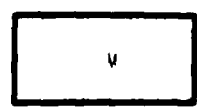
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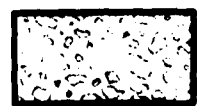
EXP



Igneous; Intrusive (I1);
Igneous; Extrusive (I2);



Metamorphic (M); metamorphic
quartz, feldspar, biotite



Sedimentary (S); predominantly
(massively to indistinctly)
dominantly biotite-quartz

SURFI

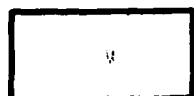
EXPLANATION

5

ROCK UNITS



Igneous; Intrusive (I1); predominantly fine to coarse grained quartz monzonite.
Igneous; Extrusive (I2); predominantly basalt.



Metamorphic (M); metamorphic complexes of gneiss and schist; mineral compositions of quartz, feldspar, biotite, muscovite, amphibole, and epidote.



Sedimentary (S); predominantly arkosic sandstone and granite-gneiss boulder conglomerate (massively to indistinctly bedded); cobble and boulder clasts in conglomerate are predominantly biotite-quartz monzonite, schist, and gneiss.

SURFICIAL BASIN-FILL UNITS



Undifferentiated Alluvium

SYMBOLS



APPROXIMATE DEPTH TO BASEMENT CONTOUR; Contour interval 500 feet (154 meters); zero depth contour represents generalized outline of basement rock outcrop. All others are computer derived in combination with manual adjustment where necessary to better fit zero contour configuration.



GEOLOGIC CONTACT; Rock basin fill where line is solid, rock and colluvium basin fill where line is dashed. (Colluvium cannot be illustrated at presentation scale due to limited extent).



FAULT; Approximately located, dotted where concealed by surficial deposits, queried where existence uncertain.



Line of Gravity/Magnetic Profile

GRAVITY ANOMALIES

L_n

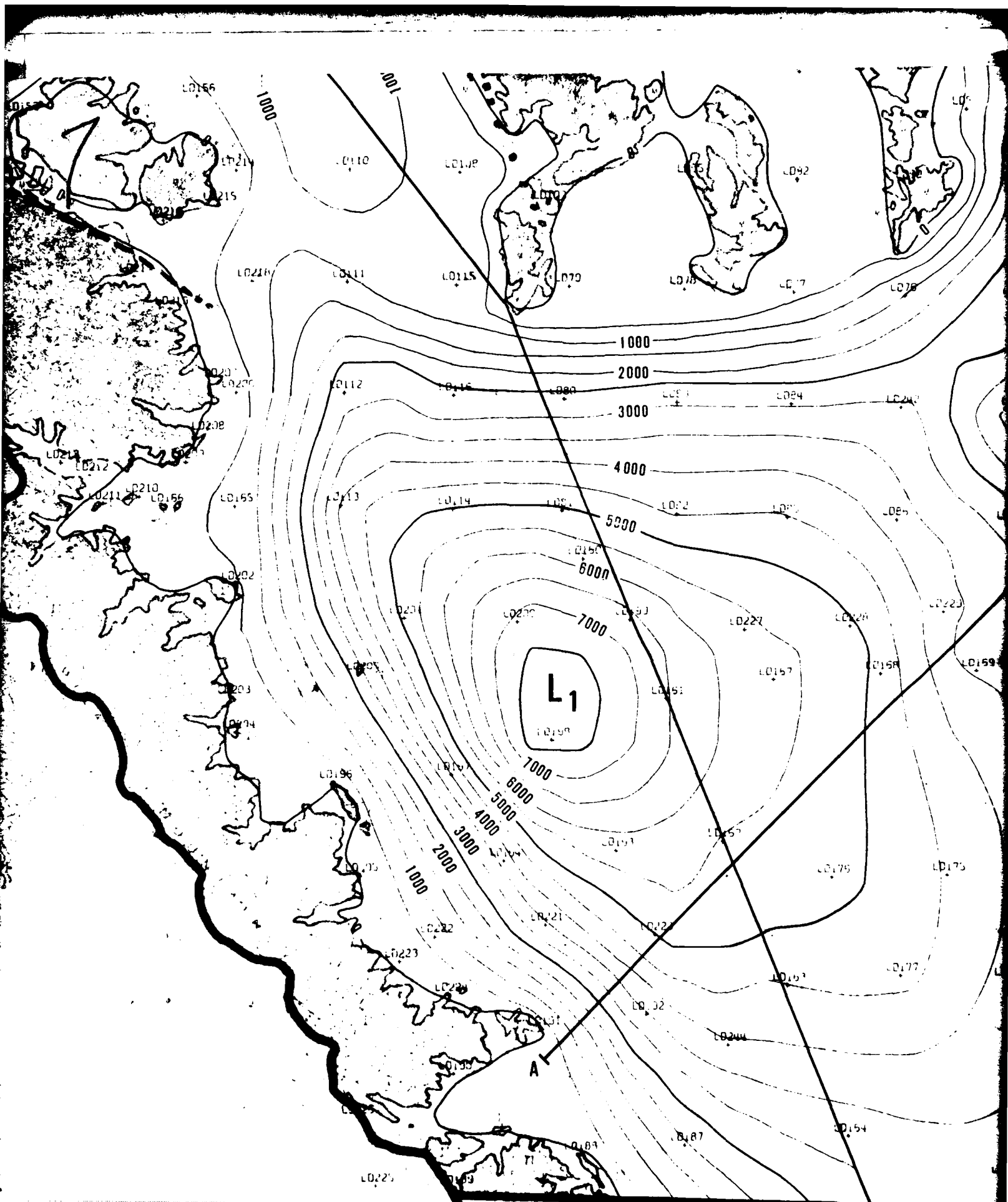
RELATIVE BASEMENT LOW

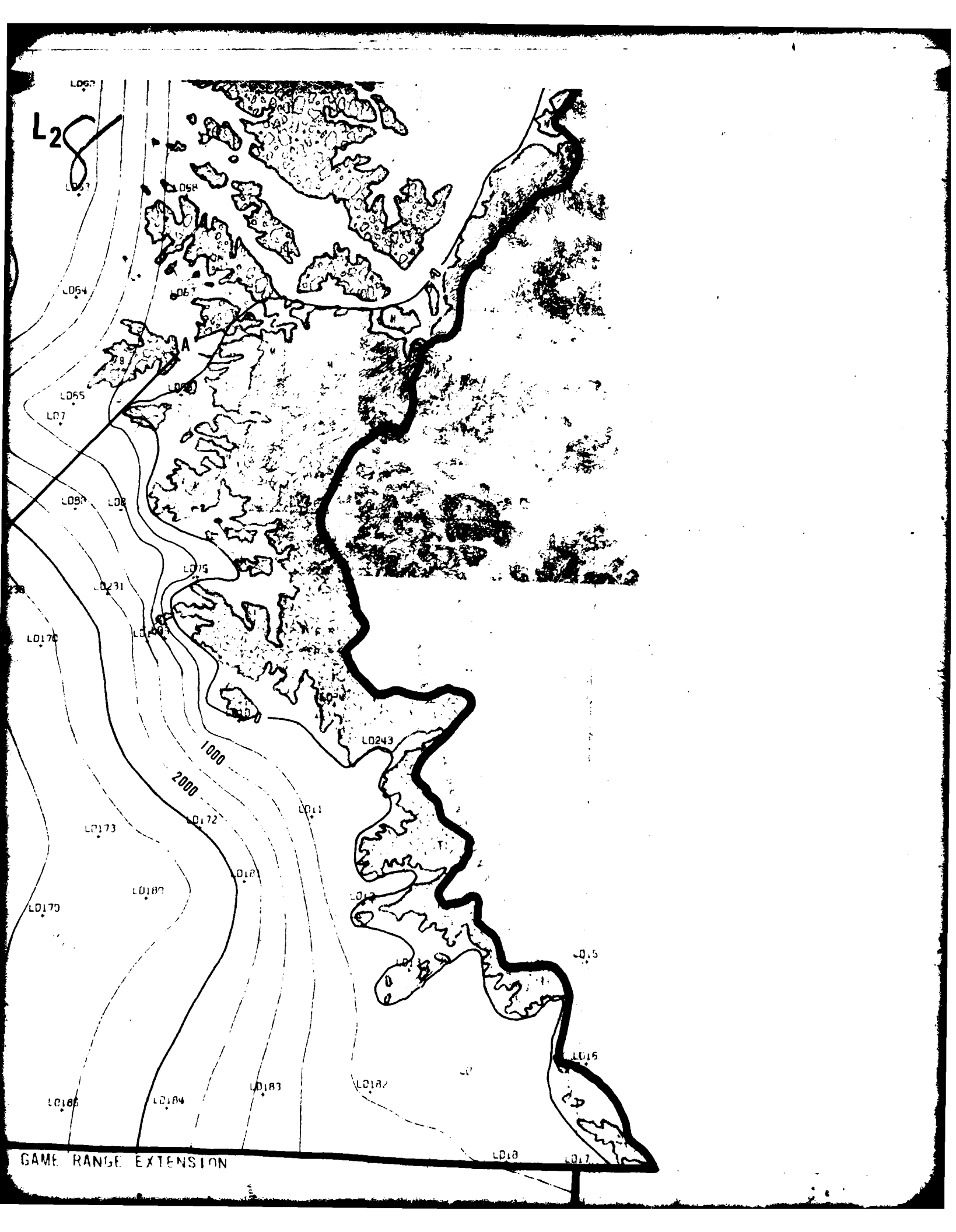
H_n

RELATIVE BASEMENT HIGH

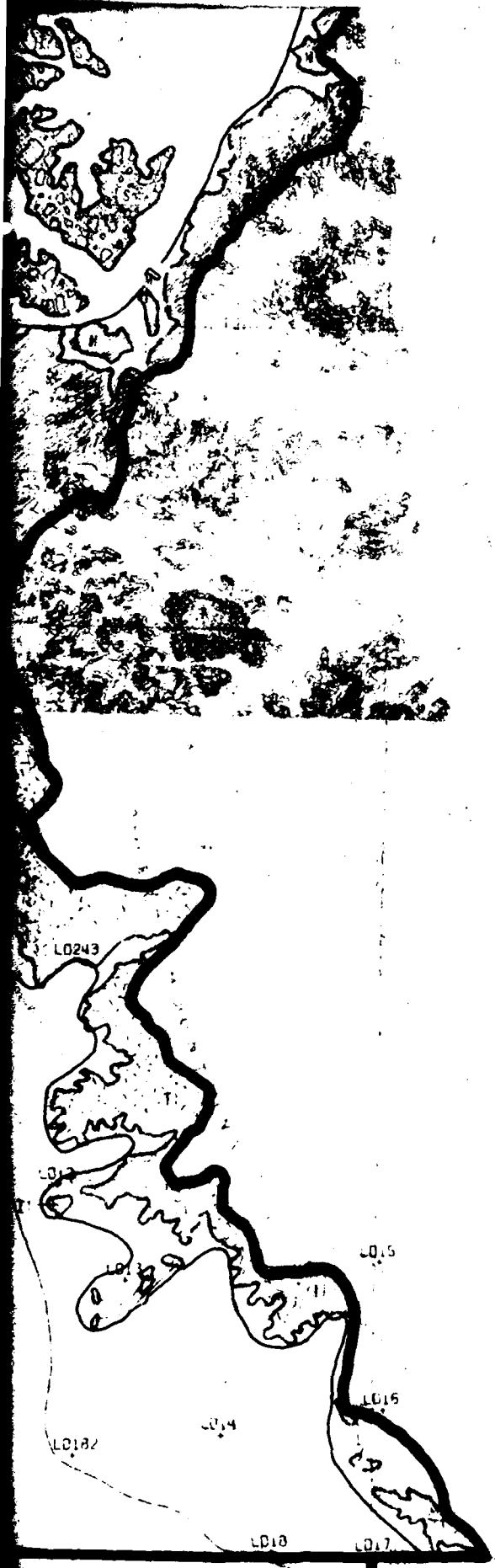
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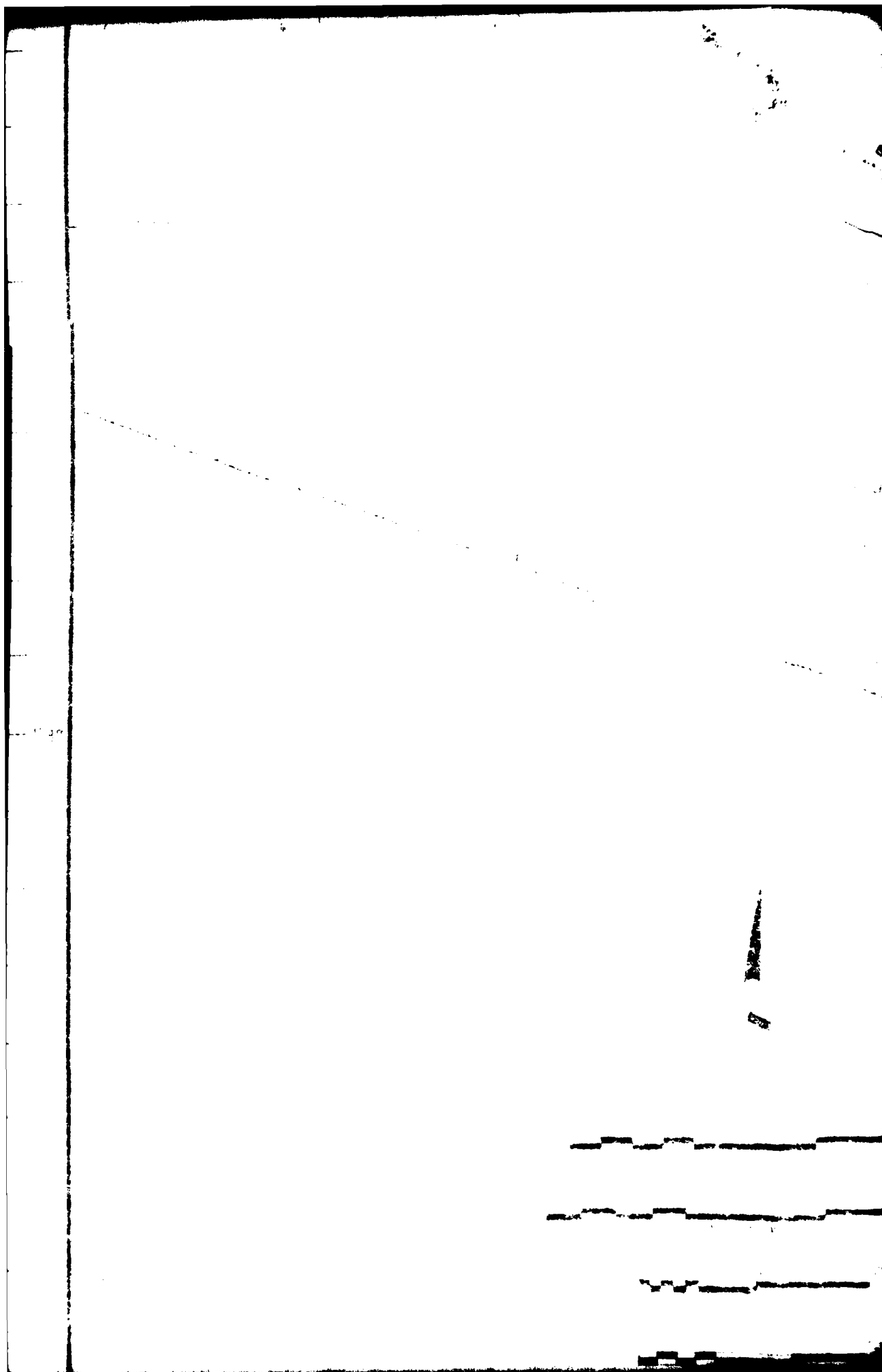






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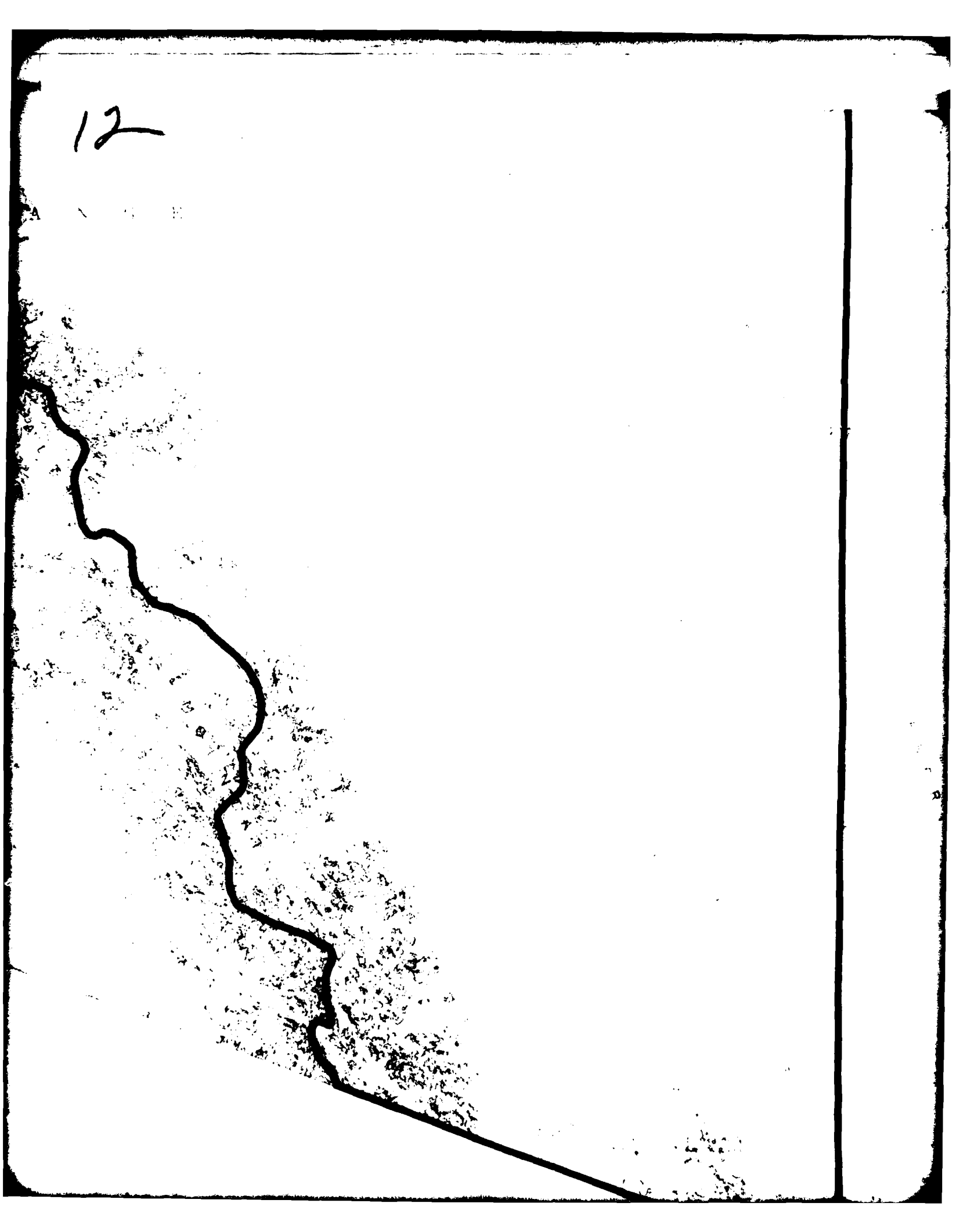


11

N I R F C R E

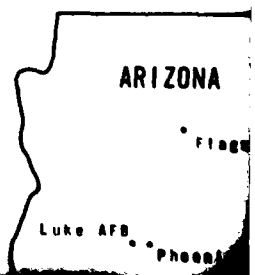
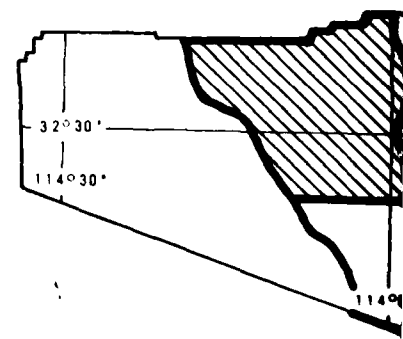


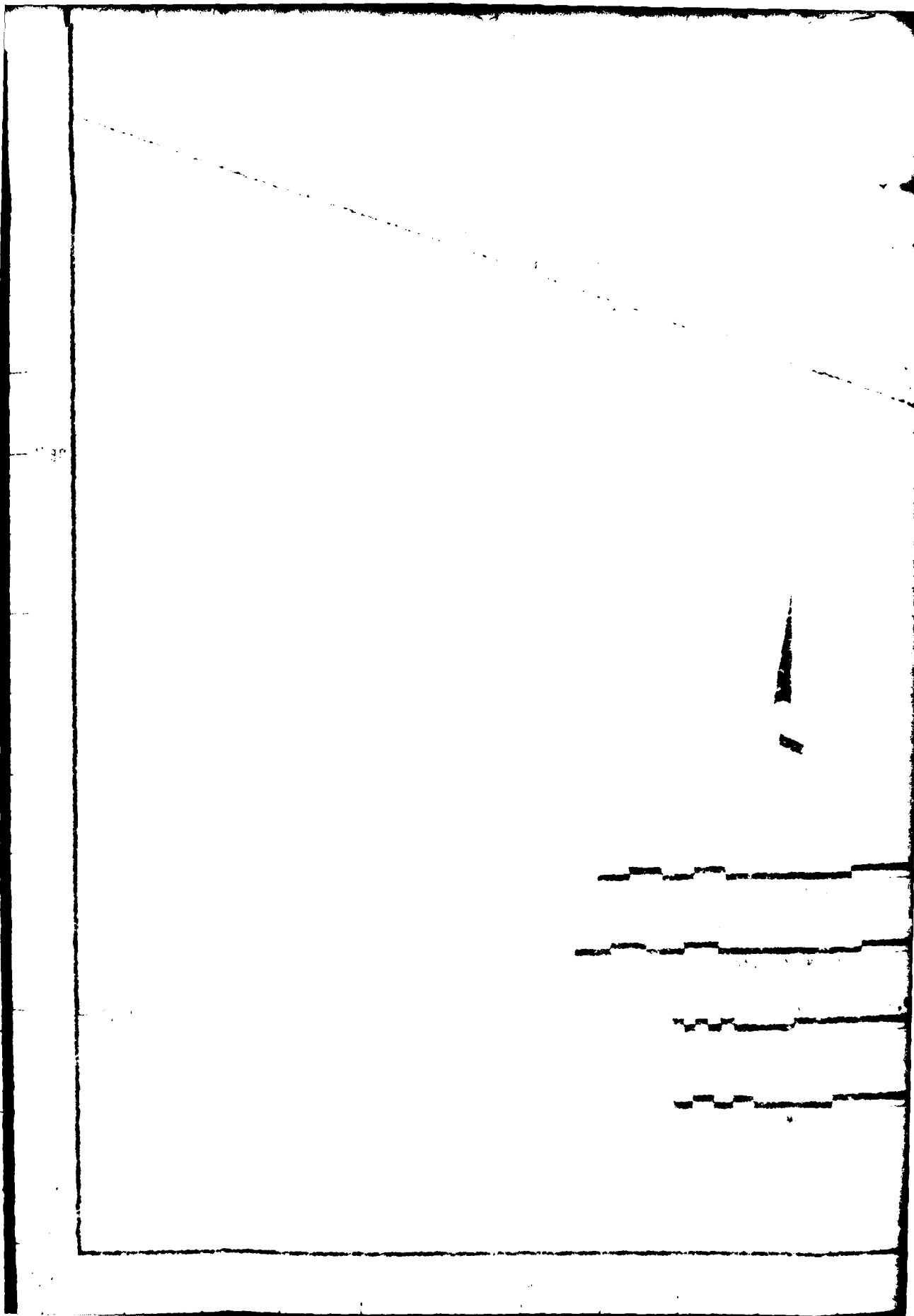
12



13

A I R F O





✓ ✓ ✓ ✓

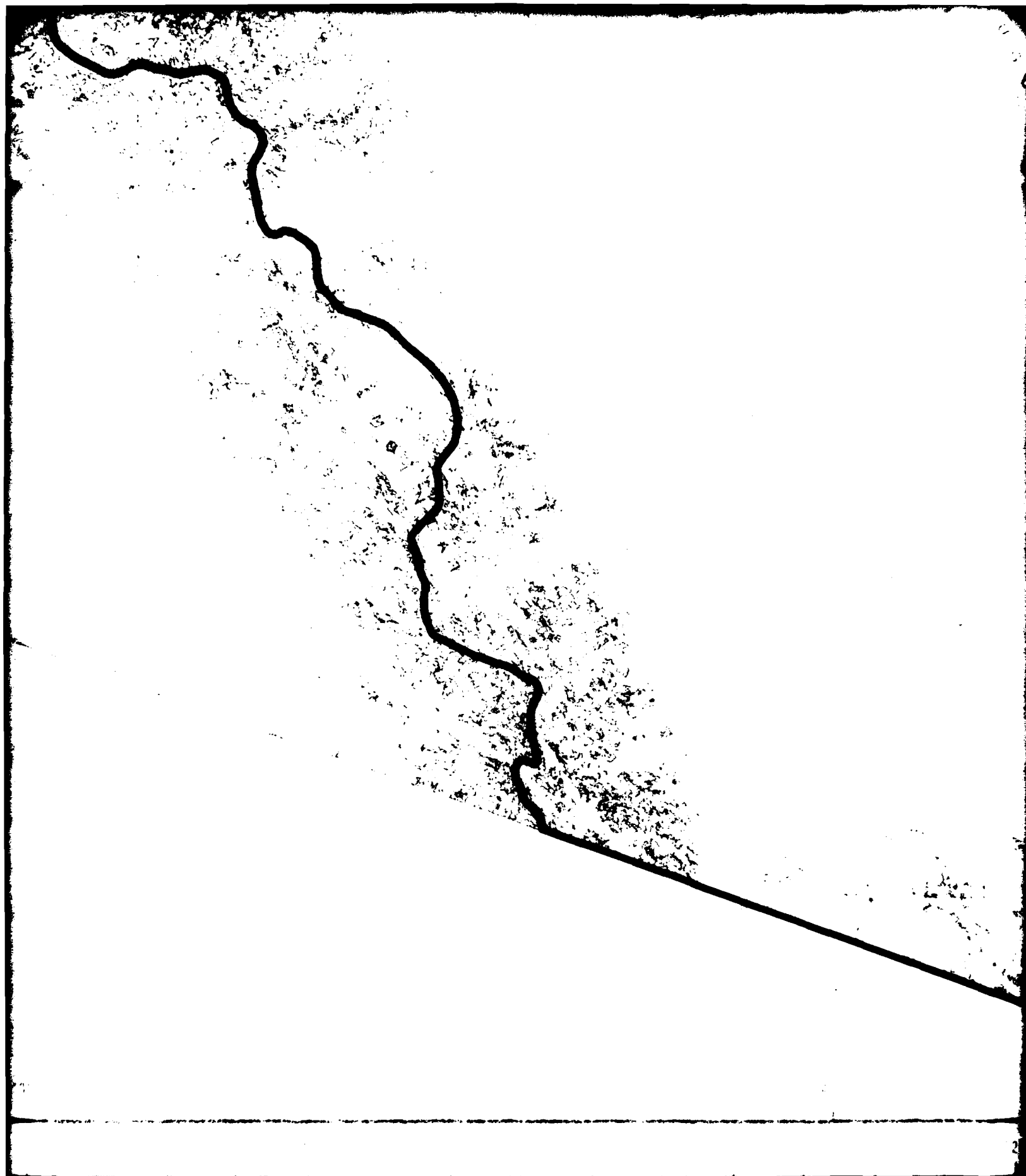
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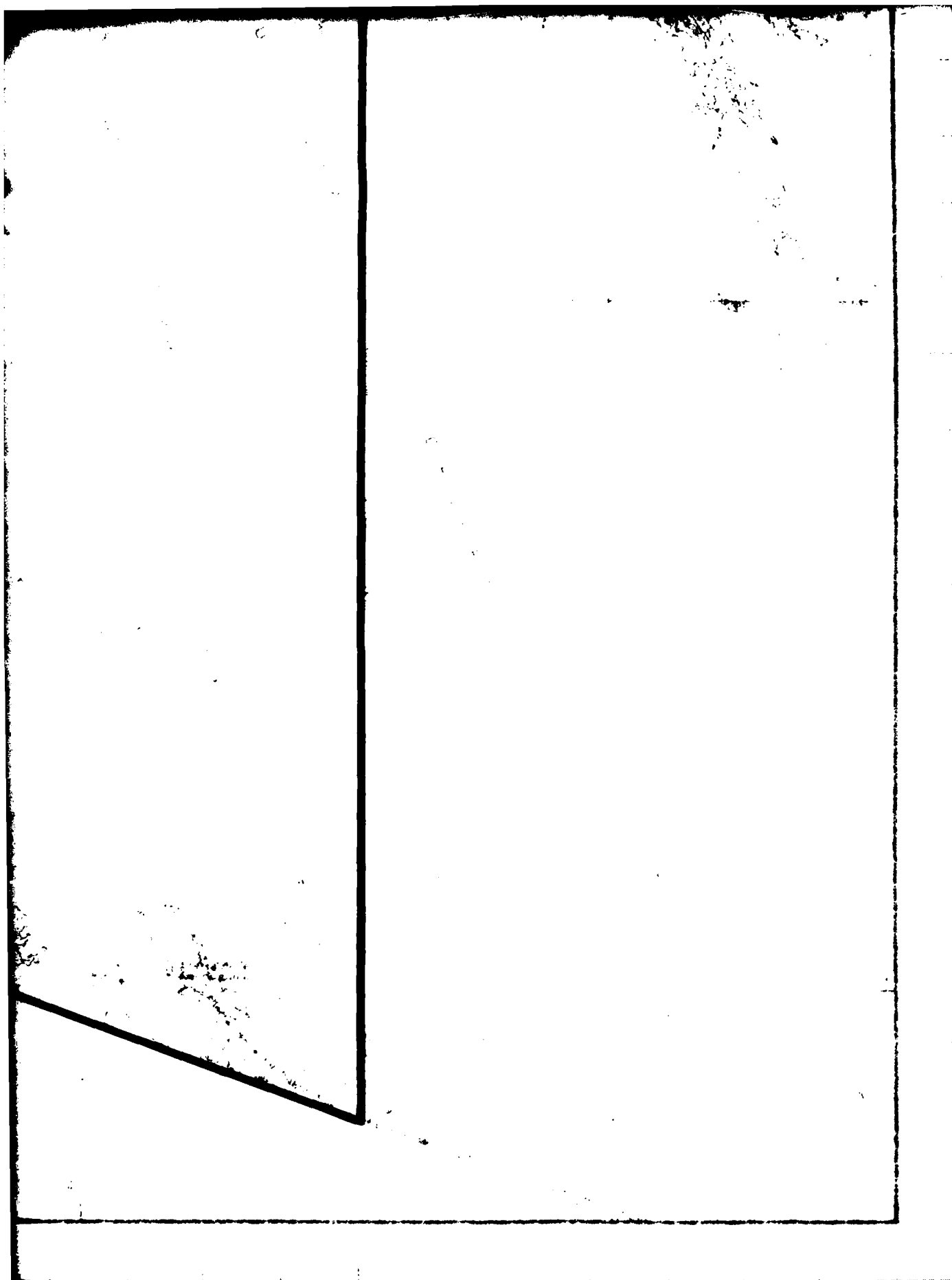
FLA 4

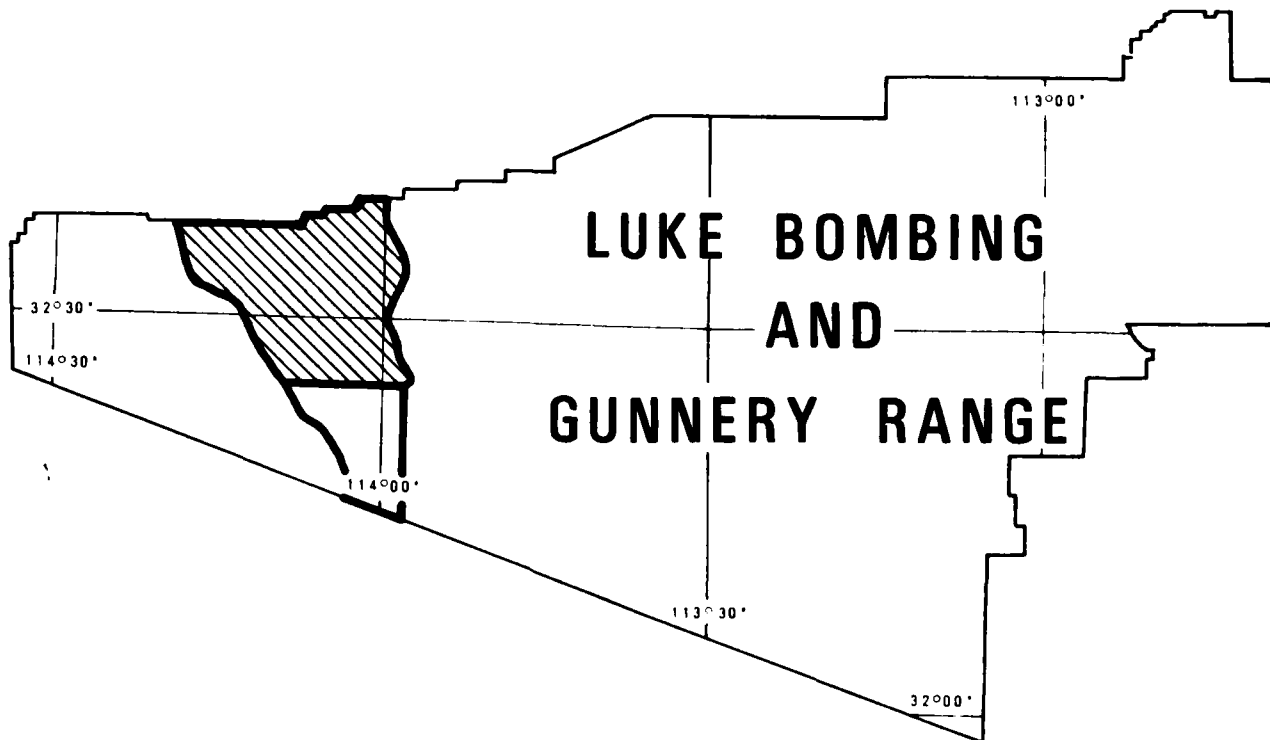
5. 6

▶ **10. 10. 2011**

404



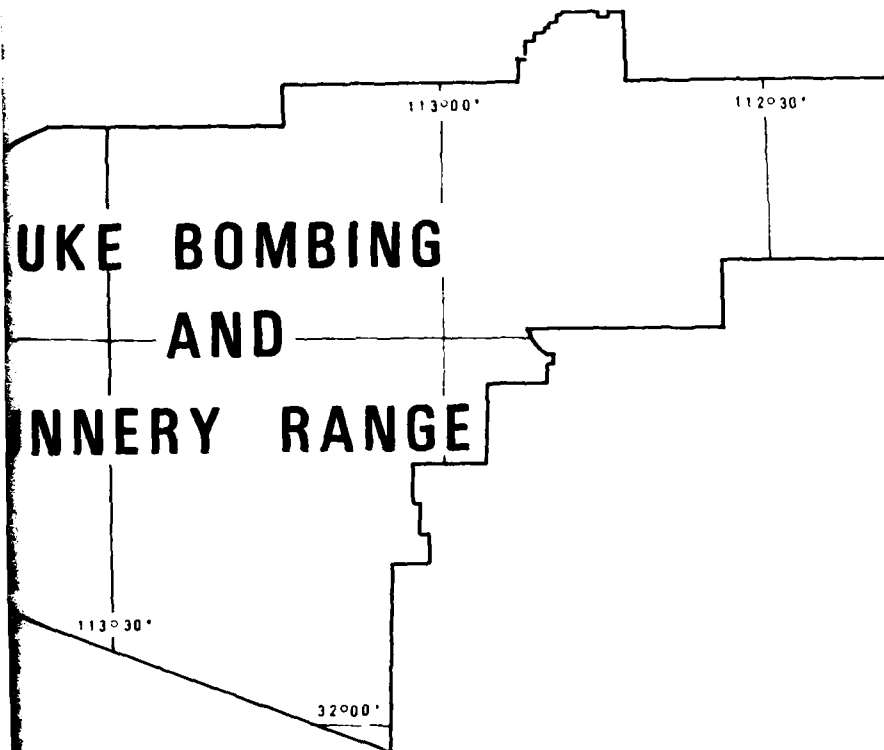




DEPTH
LECHUGUILLA

MX SITING INV
DEPARTMENT OF THE A

FUGRO NA



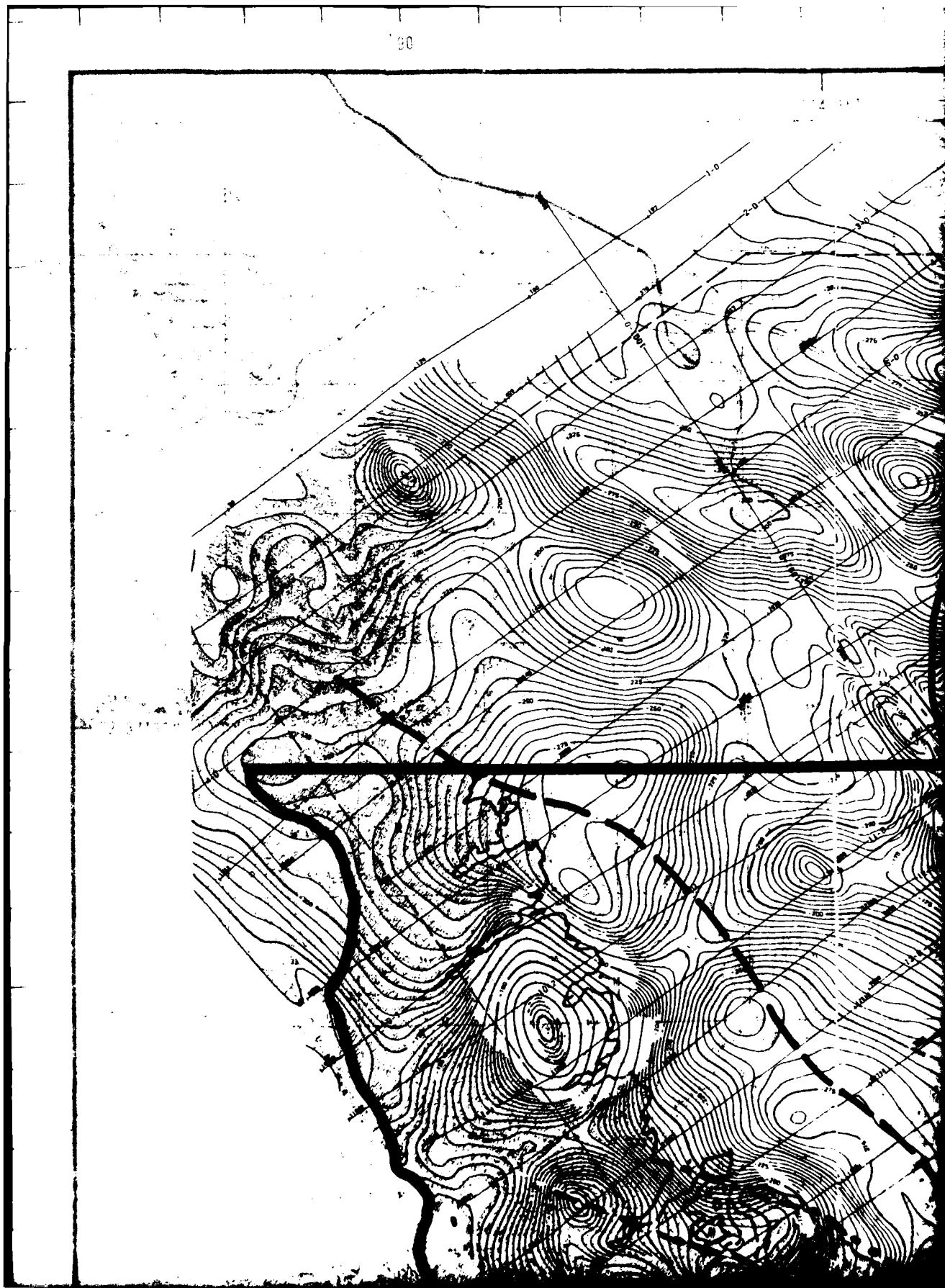
DEPTH TO BASEMENT
LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

DRAWING

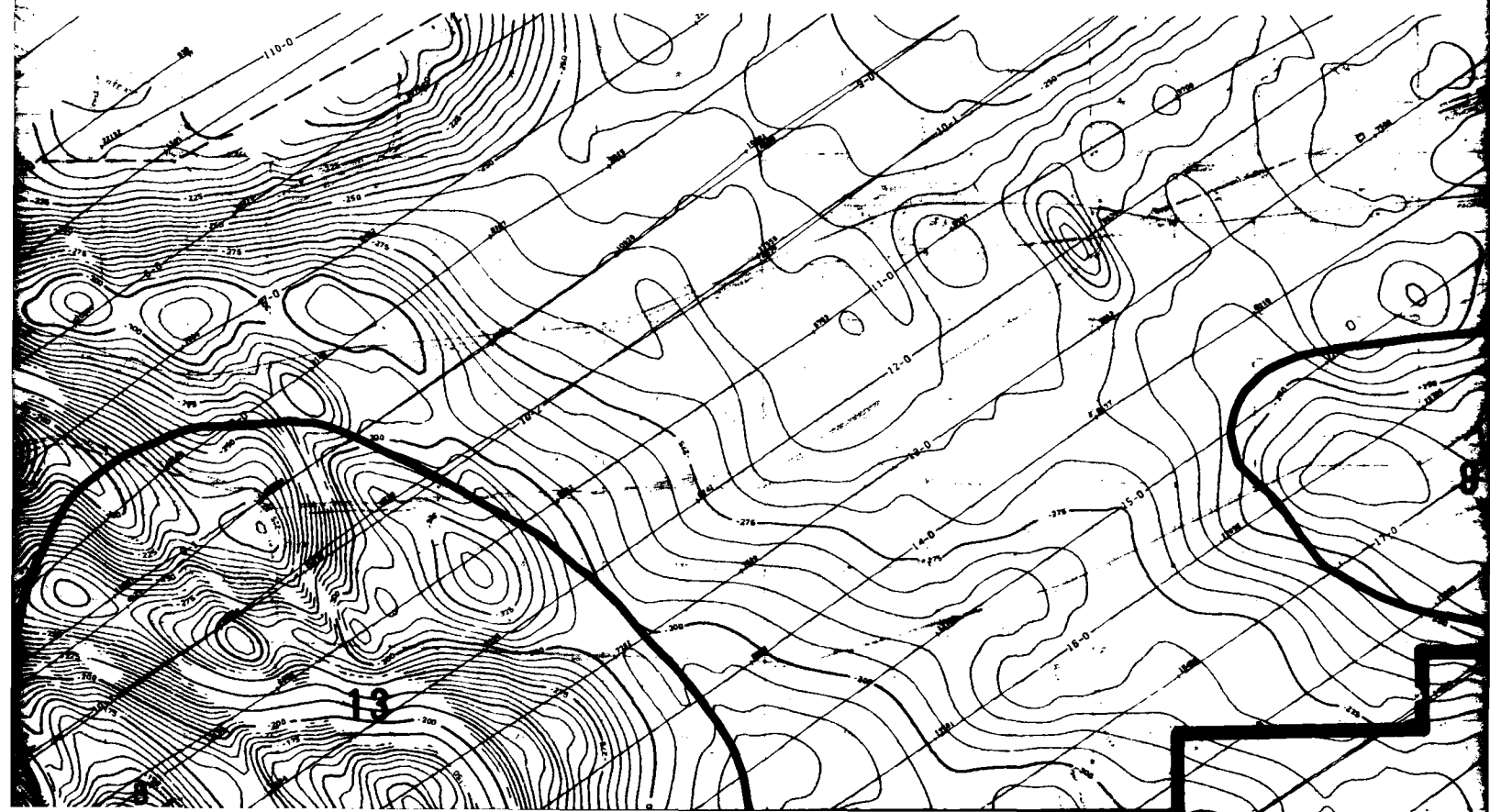
A-2

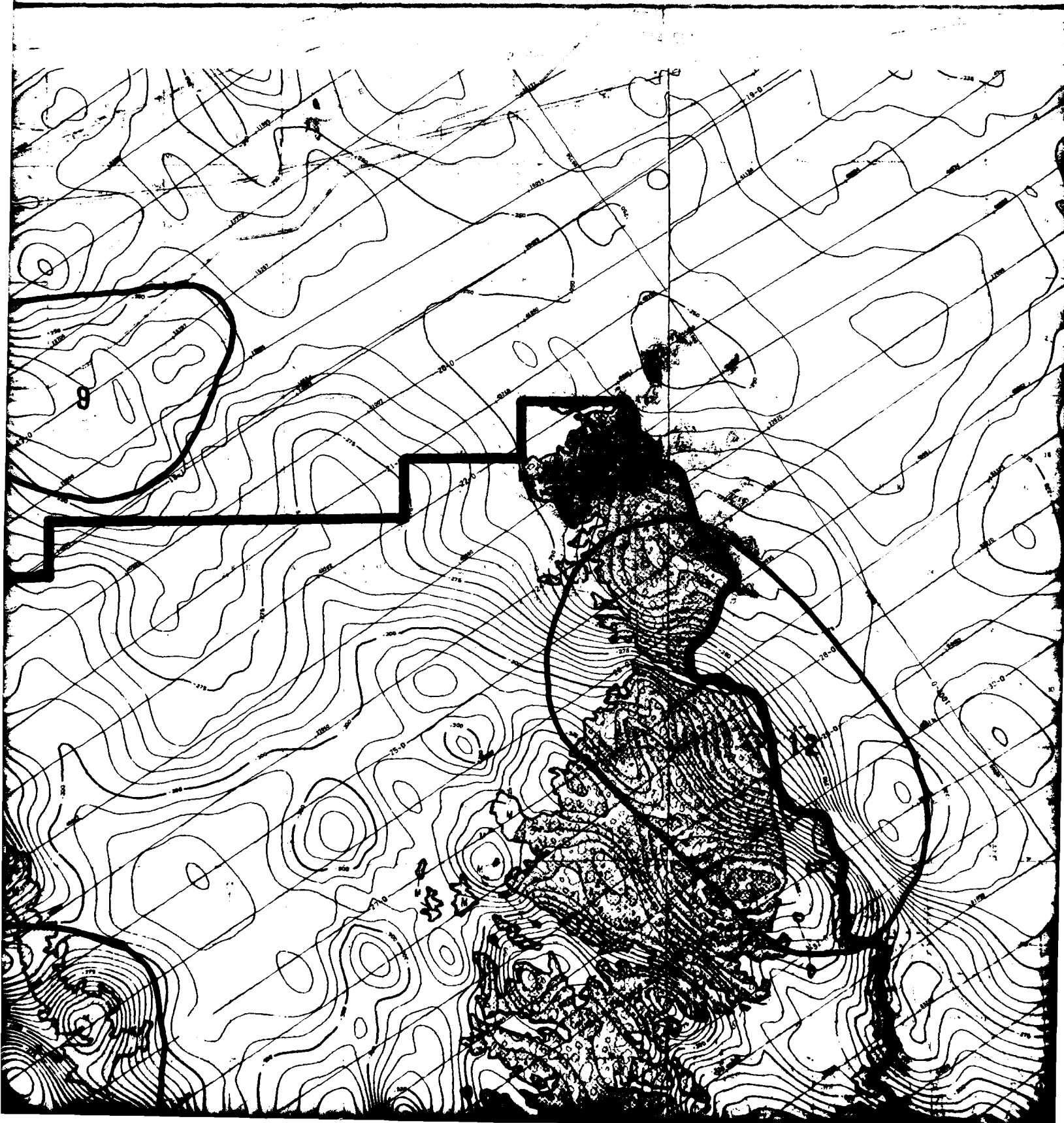
FUGRO NATIONAL INC.



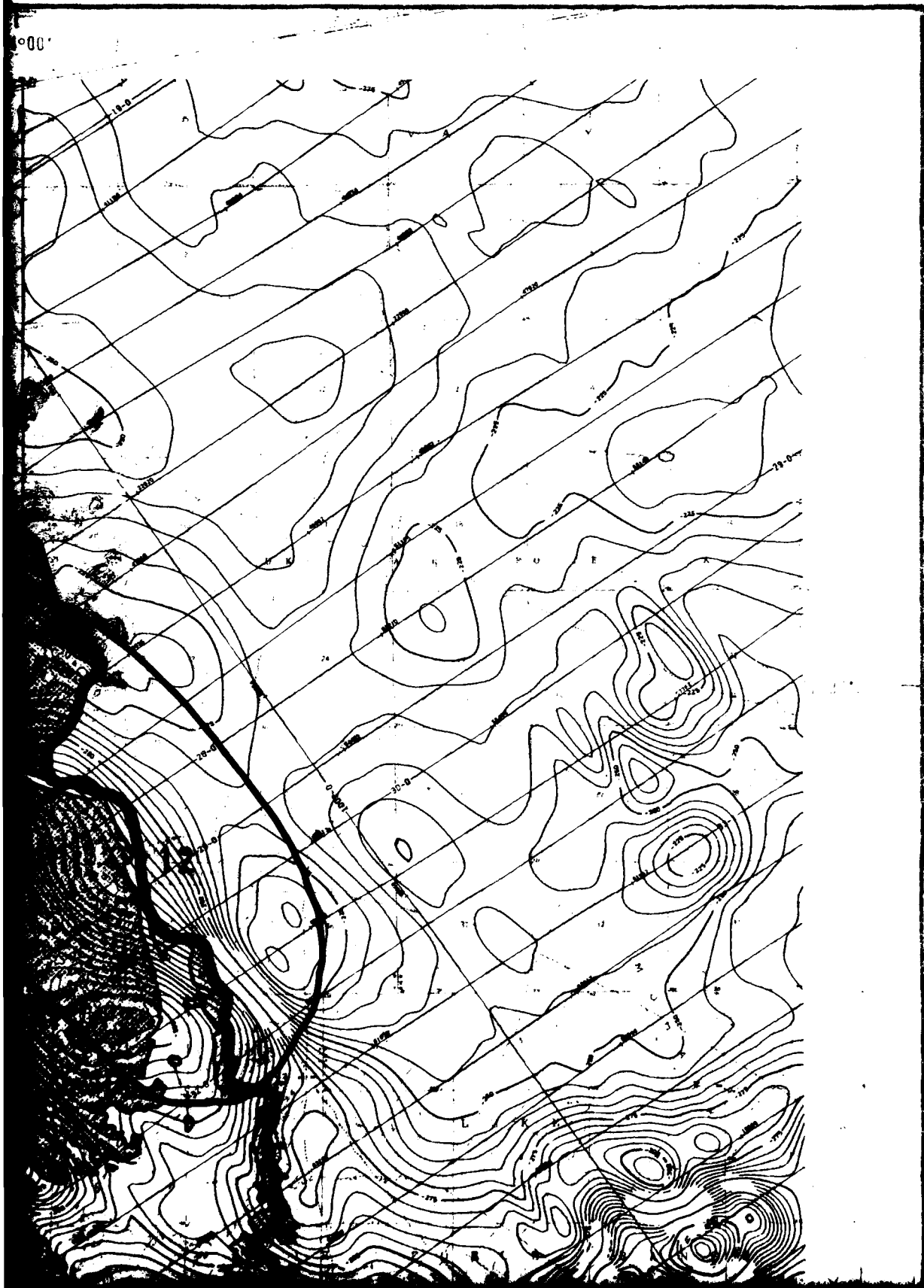
70

114 7'33"





000



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EXPLANATION

ROCK UNITS



Igneous; Intrusive (I1); predominantly fine to coarse grained quartz monzonite.
Igneous; Extrusive (I2); predominantly basalt.



Metamorphic (M); metamorphic complexes of gneiss and schist; mineral compositions of quartz, feldspar, biotite, muscovite, amphibole, and epidote.



Sedimentary (S); predominantly arkosic sandstone and granite-gneiss boulder conglomerate (massively to indistinctly bedded); cobble and boulder clasts in conglomerate are predominantly biotite-quartz monzonite, schist, and gneiss.

SURFICIAL BASIN-FILL UNITS



Undifferentiated Alluvium

SYMBOLS



RESIDUAL MAGNETIC INTENSITY CONTOURS; Contour interval 5 gammas.
Shading shows $\frac{1}{2}$ contour interval in direction of decreasing value.



GEOLOGIC CONTACT; Rock/basin fill where line is solid, rock and colluvium basin fill where line is dashed. (Colluvium cannot be illustrated at presentation scale due to limited extent.)



FAULT; Approximately located, dotted where concealed by surficial deposits, queried where existence uncertain.



Magnetic Anomalies (See section 3.1.3.3)



Magnetic Axis (See section 3.1.3.3)

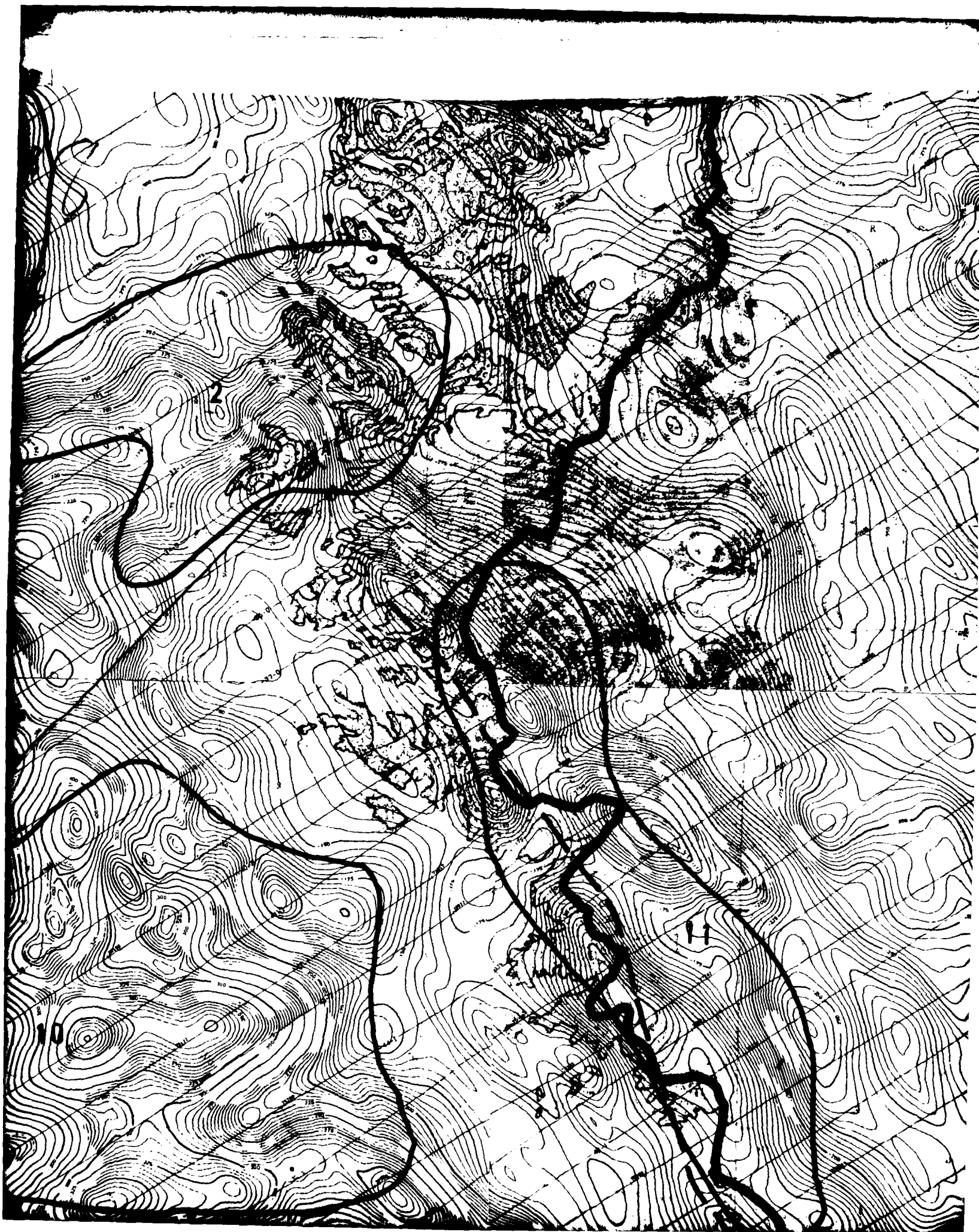


Line of Gravity/Magnetic Profile

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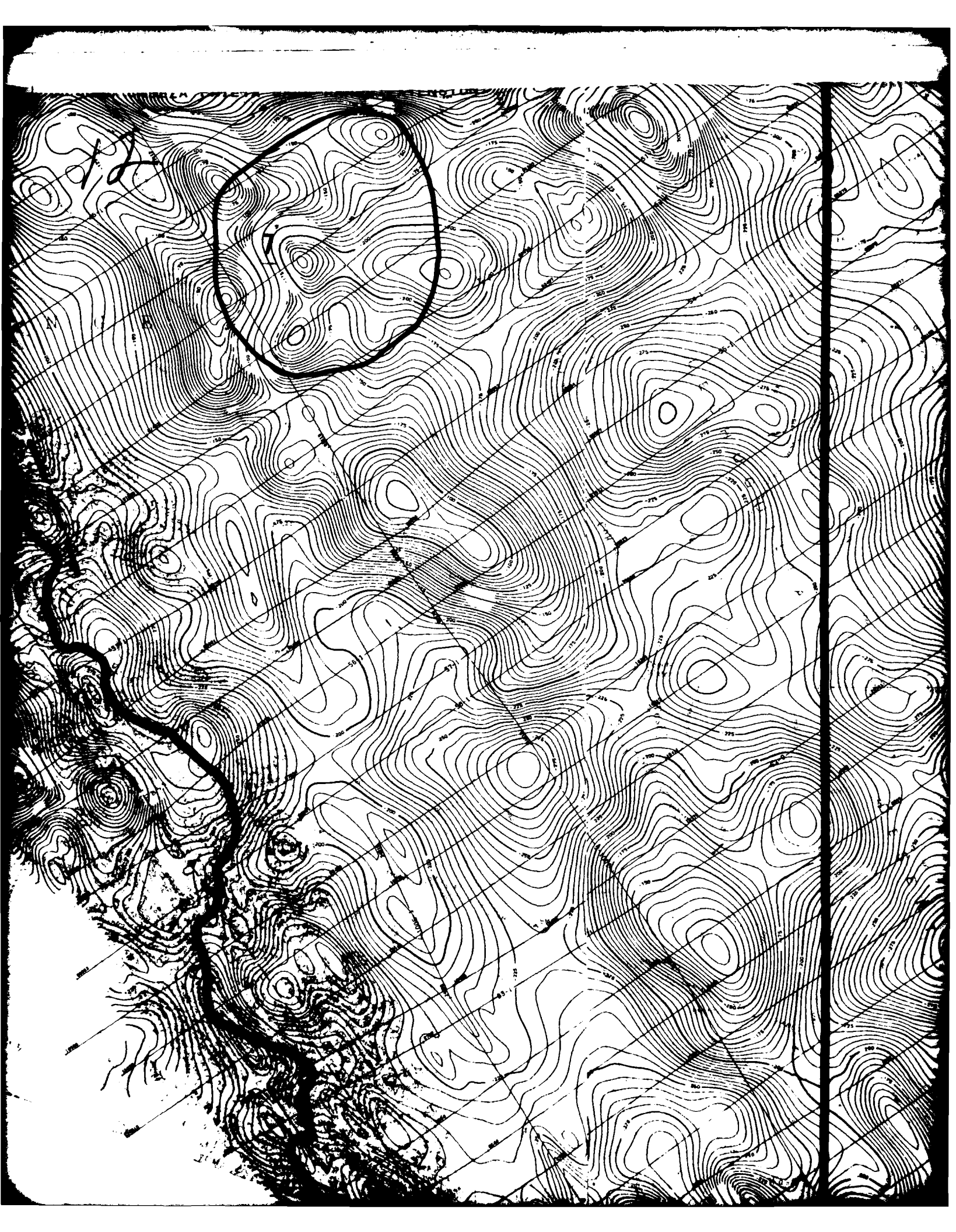
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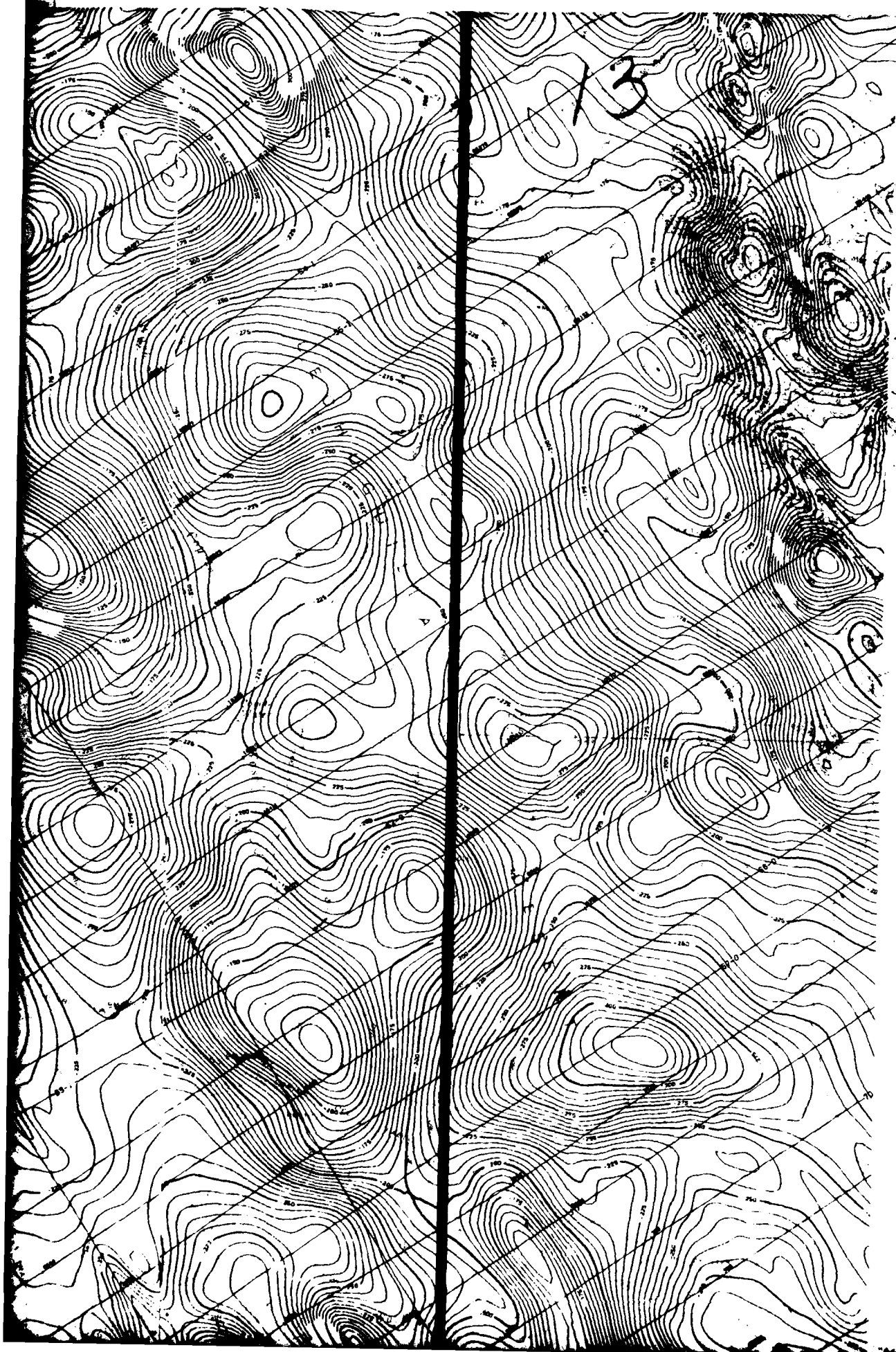
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86

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83

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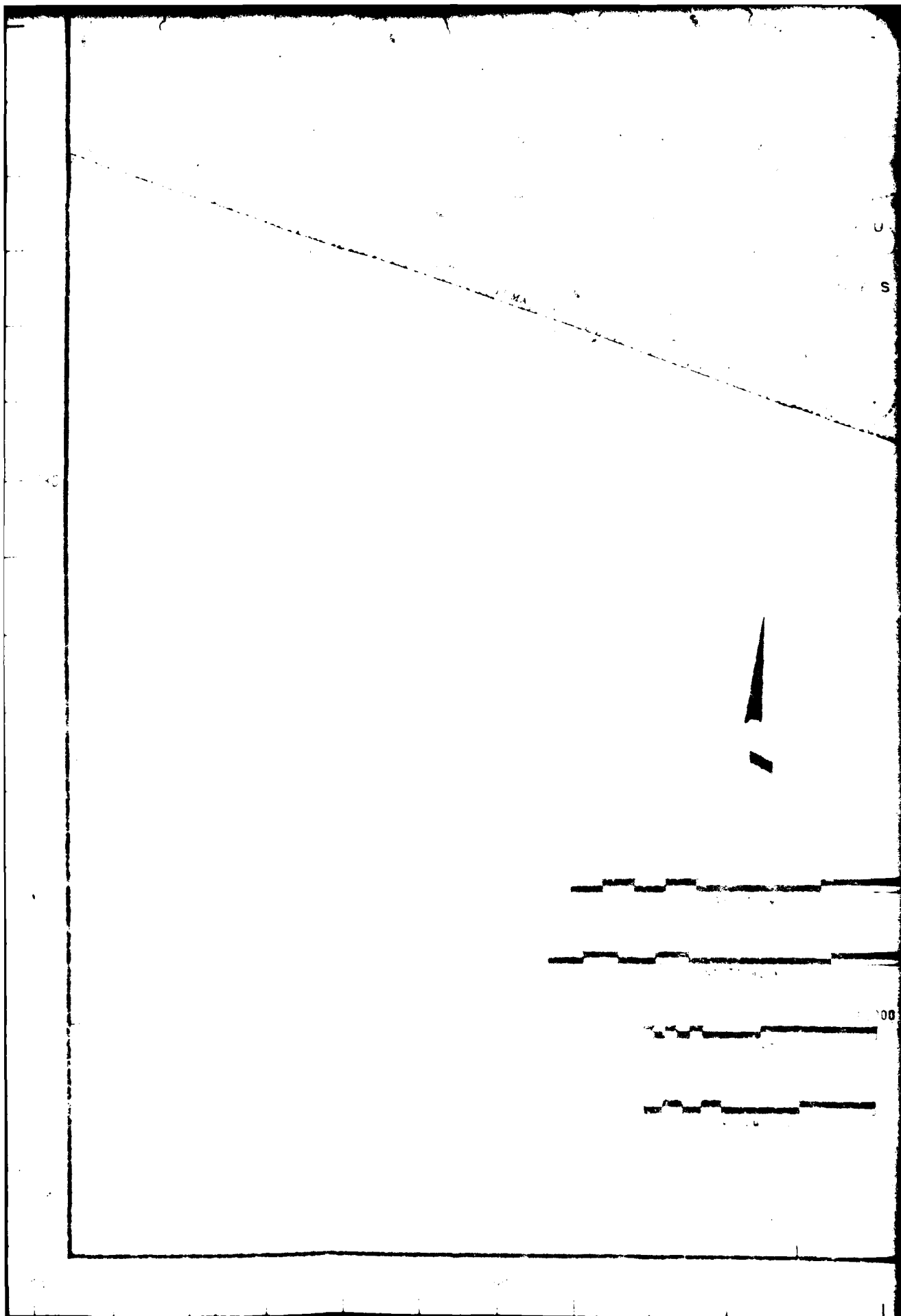
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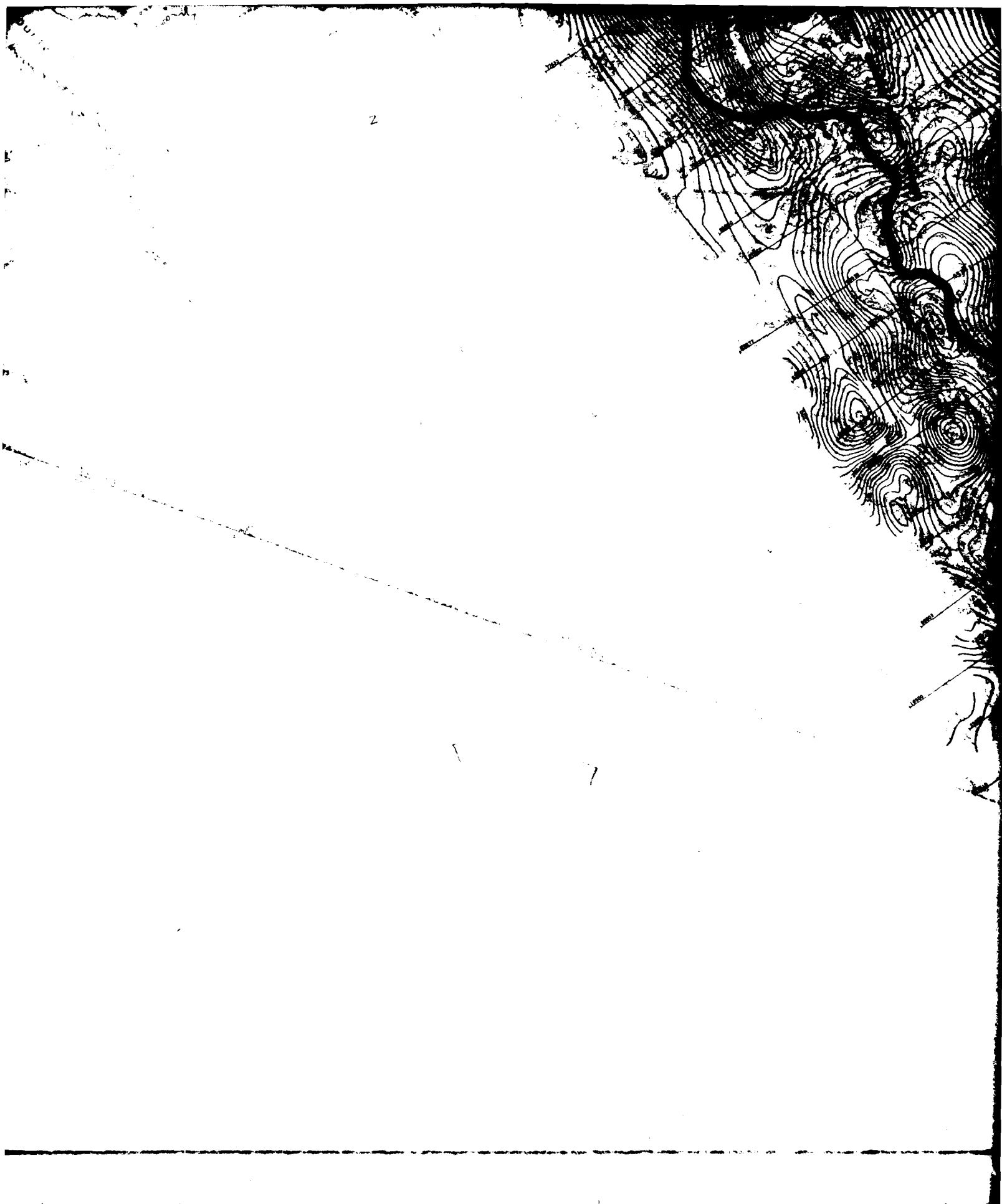
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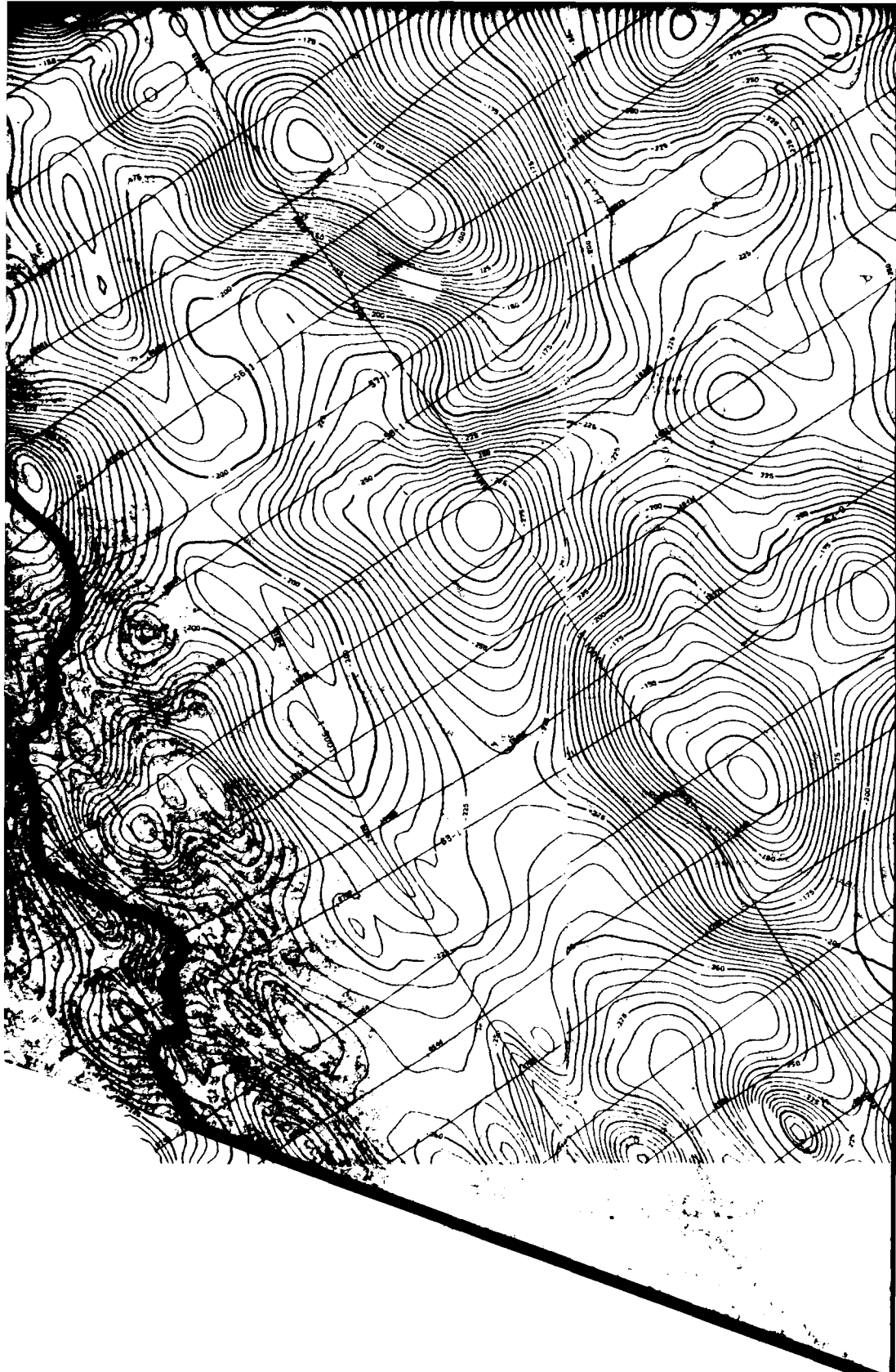
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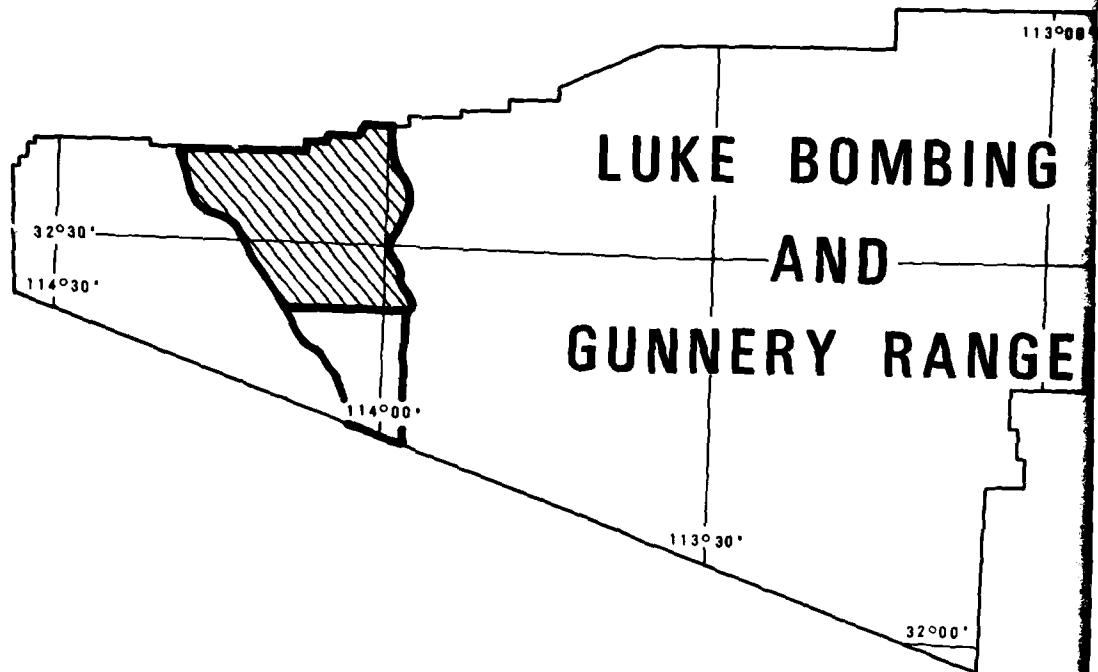
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74



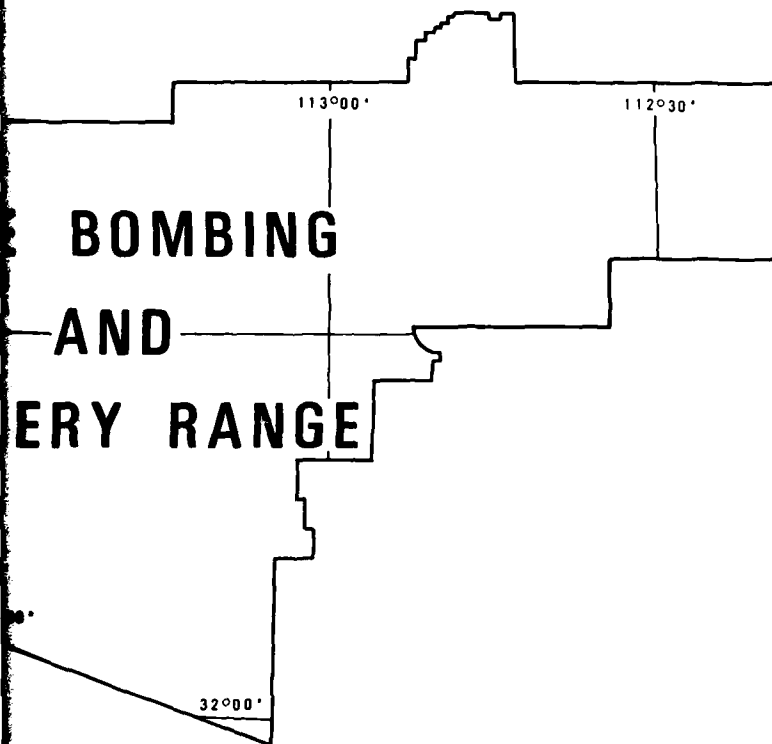






MX
DEPARTMENT

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RESIDUAL MAGNETIC INTENSITY
LECHUGUILLA DESERT, ARIZONA

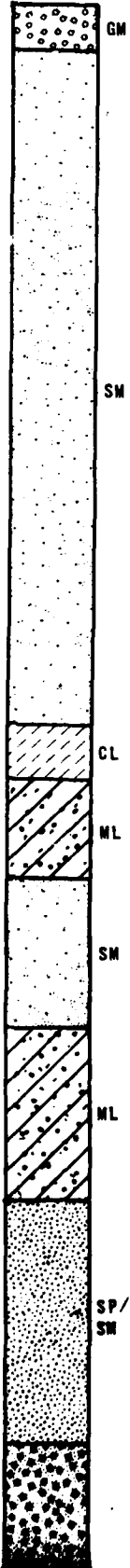
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

DRAWING

A-3

FUGRO NATIONAL, INC.

FN-TR-19



METERS

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36

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72

84

96

108

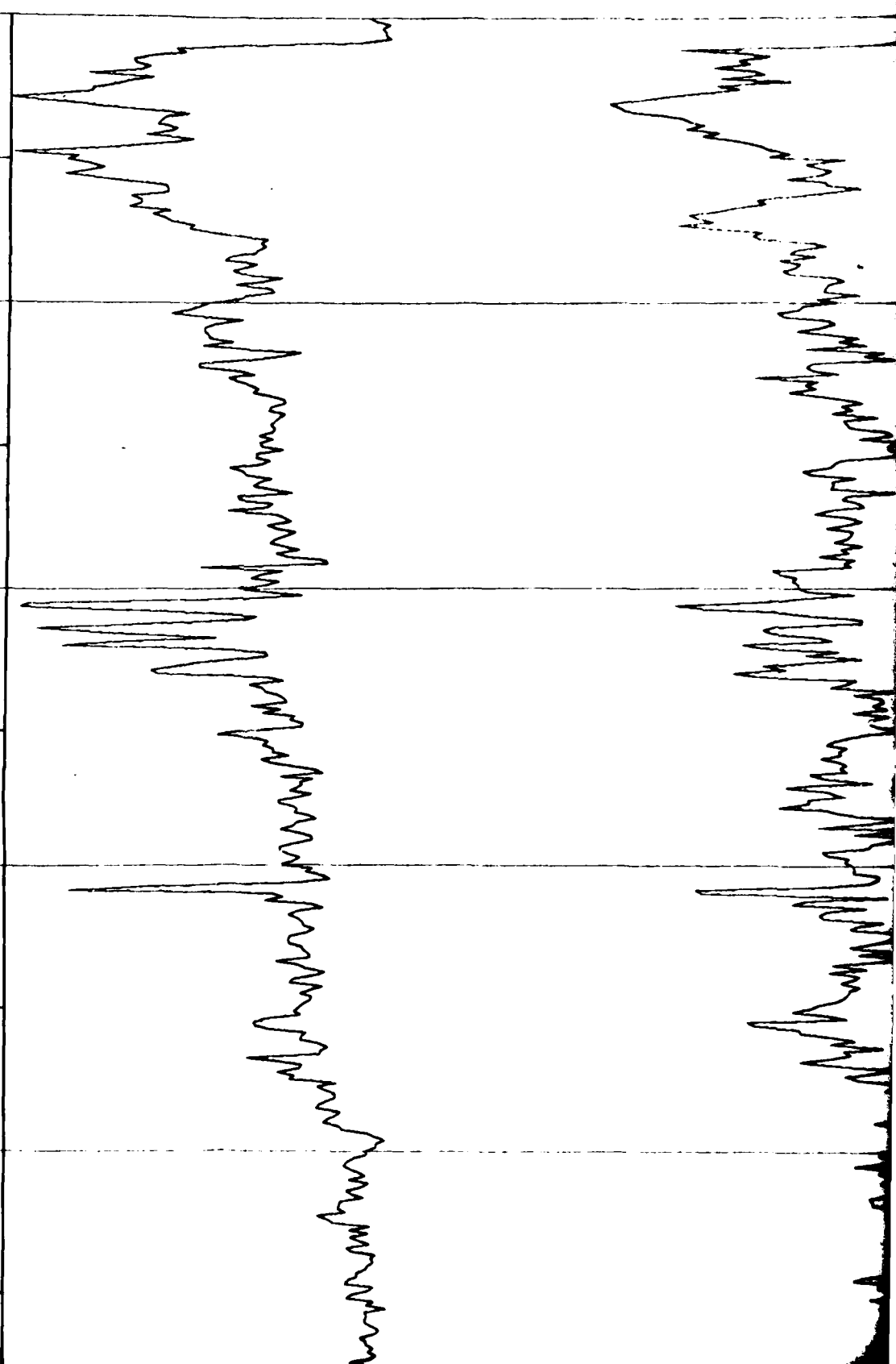
FEET

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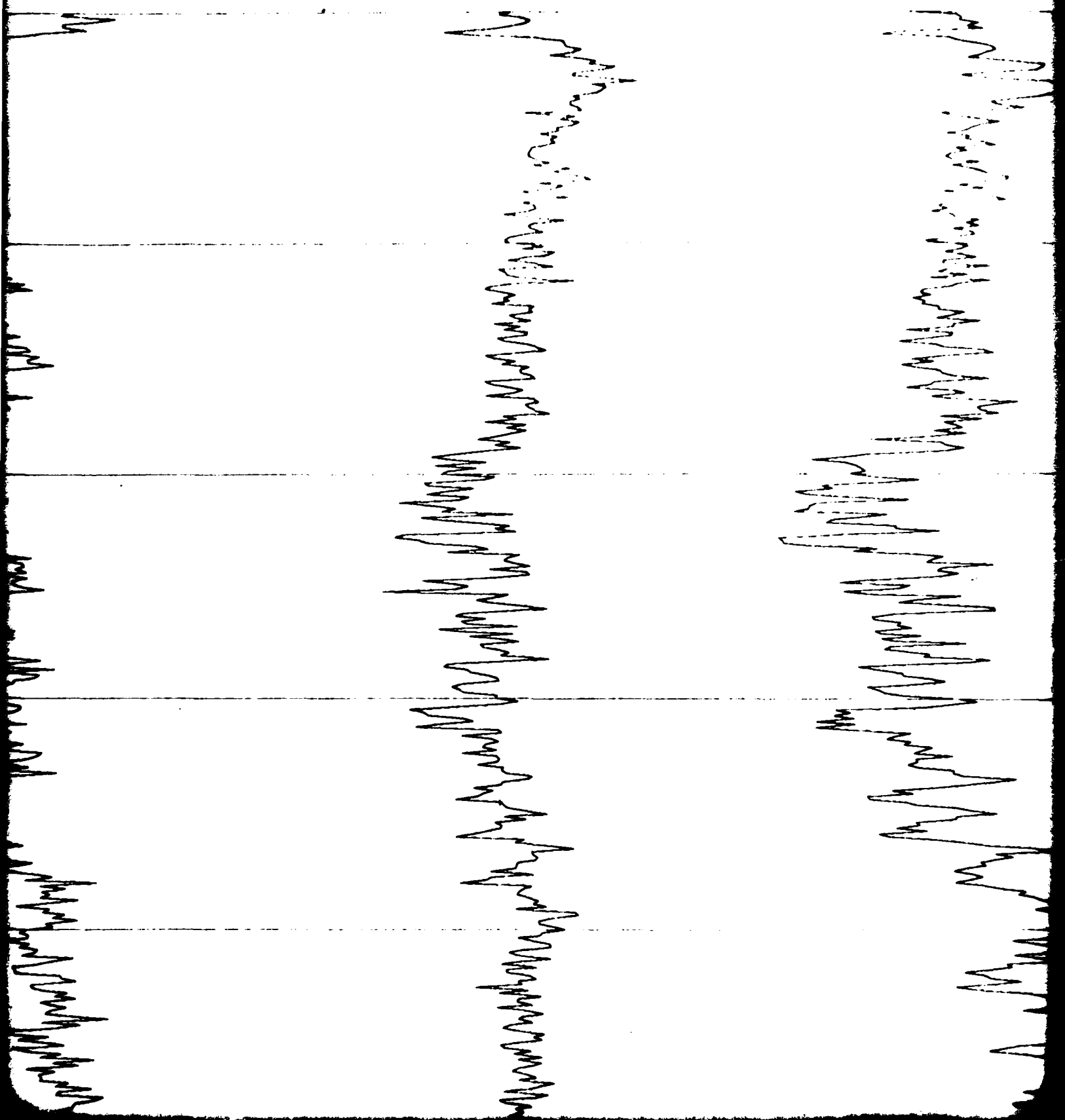
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240

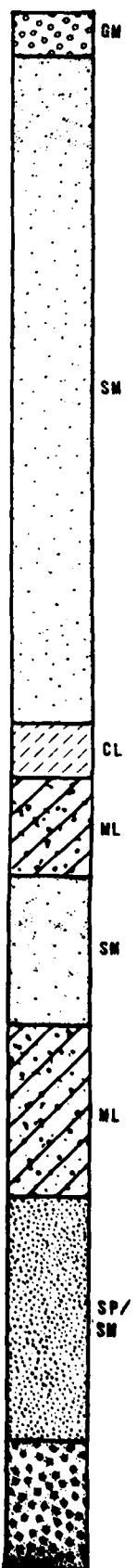
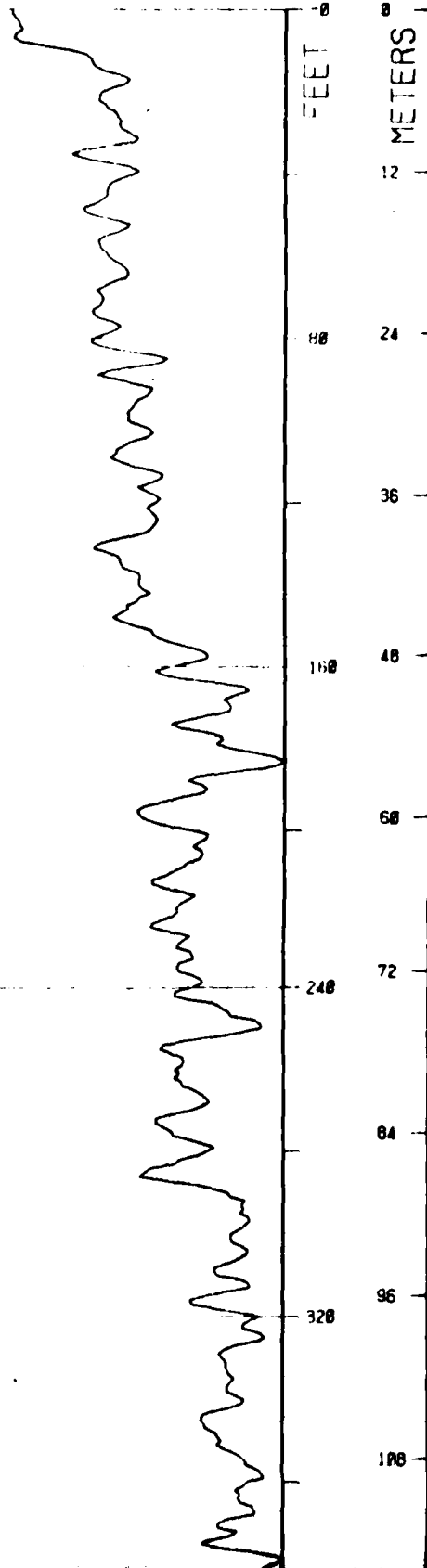
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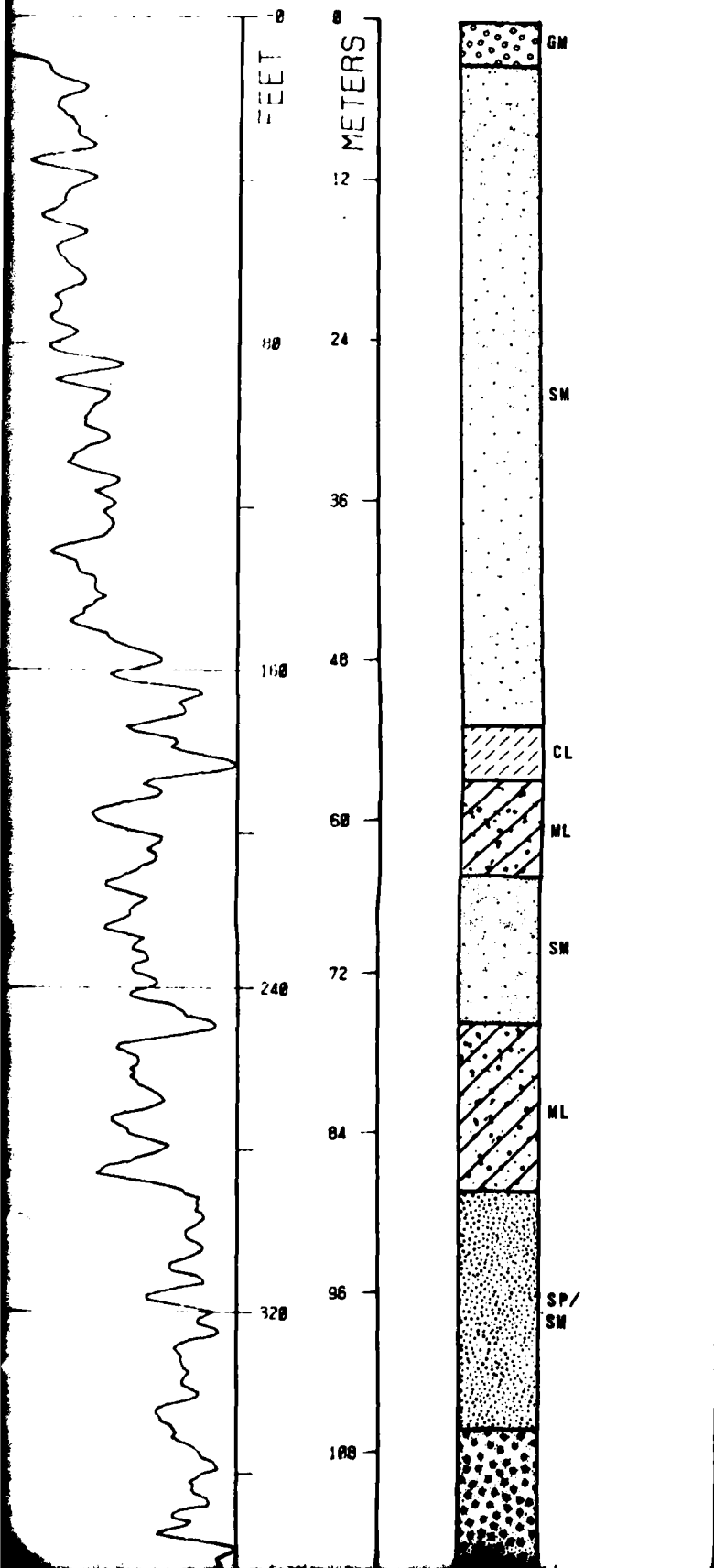


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STUDY
DATE
TOTAL
DEPTH
REMARK

LOG T
CORRECTION
DENSE
POROS
WATER

4



WASHINGTON STATE UNIVERSITY

COLLEGE OF ENGINEERING

GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

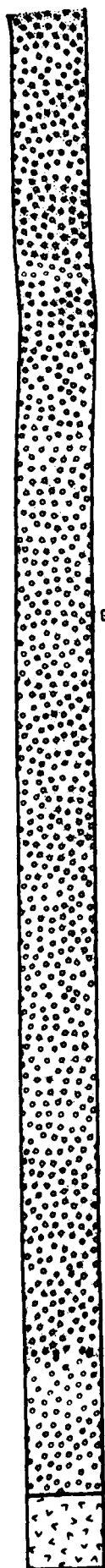
PROJECT NAME AIR FORCE
BORING NO. LO-D-2
ELEVATION 660' (201m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/20/77
TOTAL DEPTH LOGGED . . 833' (254m)
DEPTH TO WATER LEVEL . ———
REMARKS ———

EXPLANATION

LOG TITLES

NATG - - NATURAL GAMMA
GG - - GAMMA GAMMA
NN - - NEUTRON NEUTRON
NG - - NEUTRON GAMMA
FT - - FLUID TEMPERATURE
FR - - FLUID RESISTIVITY
CALP - - CALIPER
SP - - SPONTANEOUS POTENTIAL
RES - - RESISTIVITY
FMR - - FLOW METER
GM - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
POROSITY (NN-LOG) INCREASES ←
WATER LEVEL -----



5

GM

132

144

156

168

180

192

204

216

228

240

480

560

640

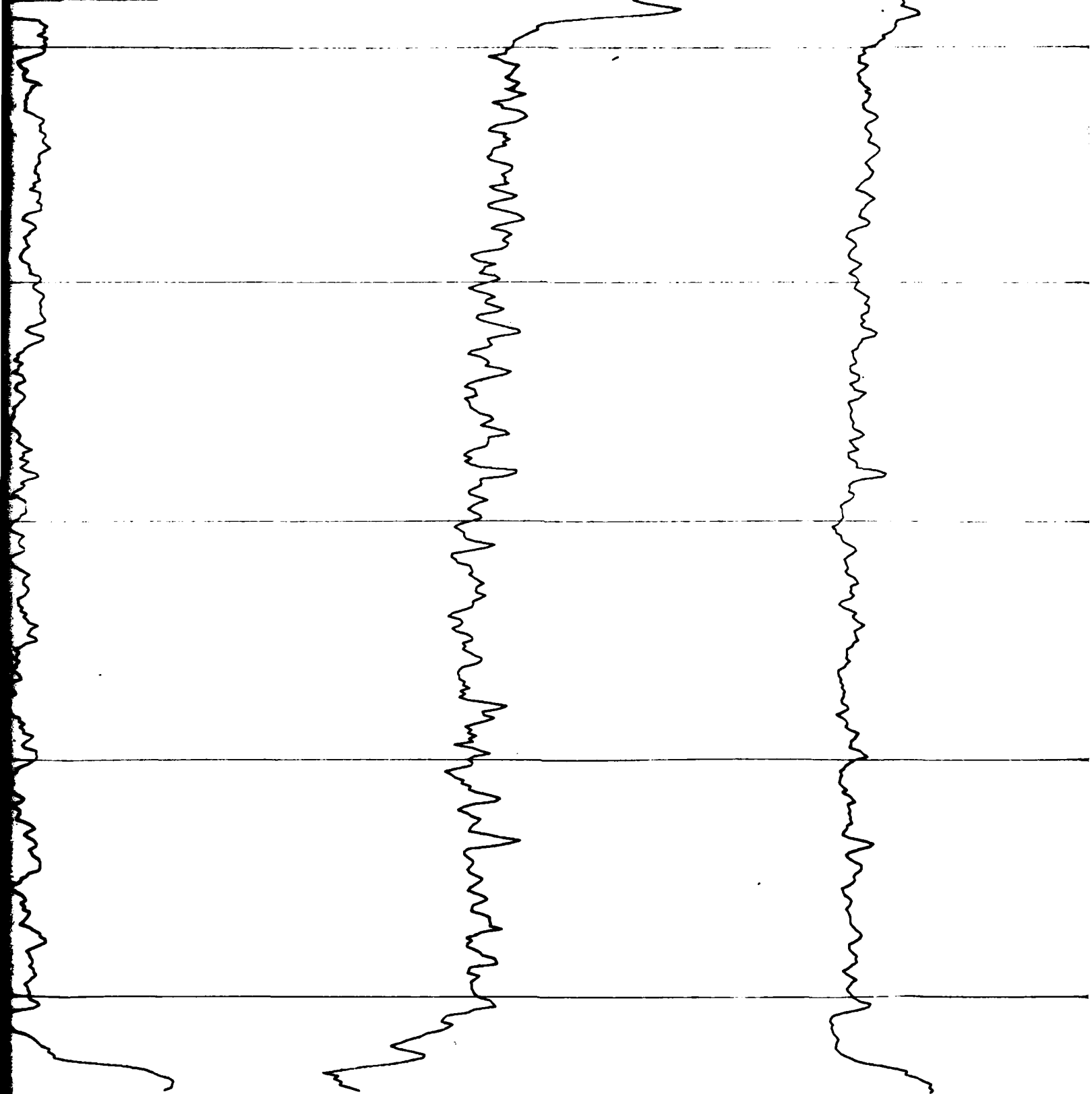
720

800



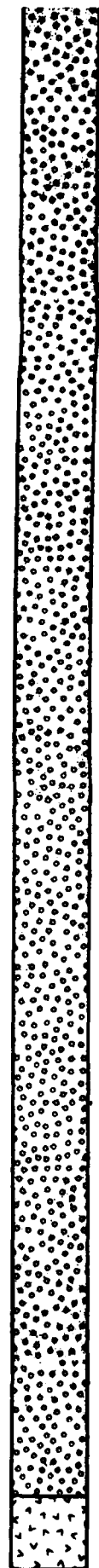
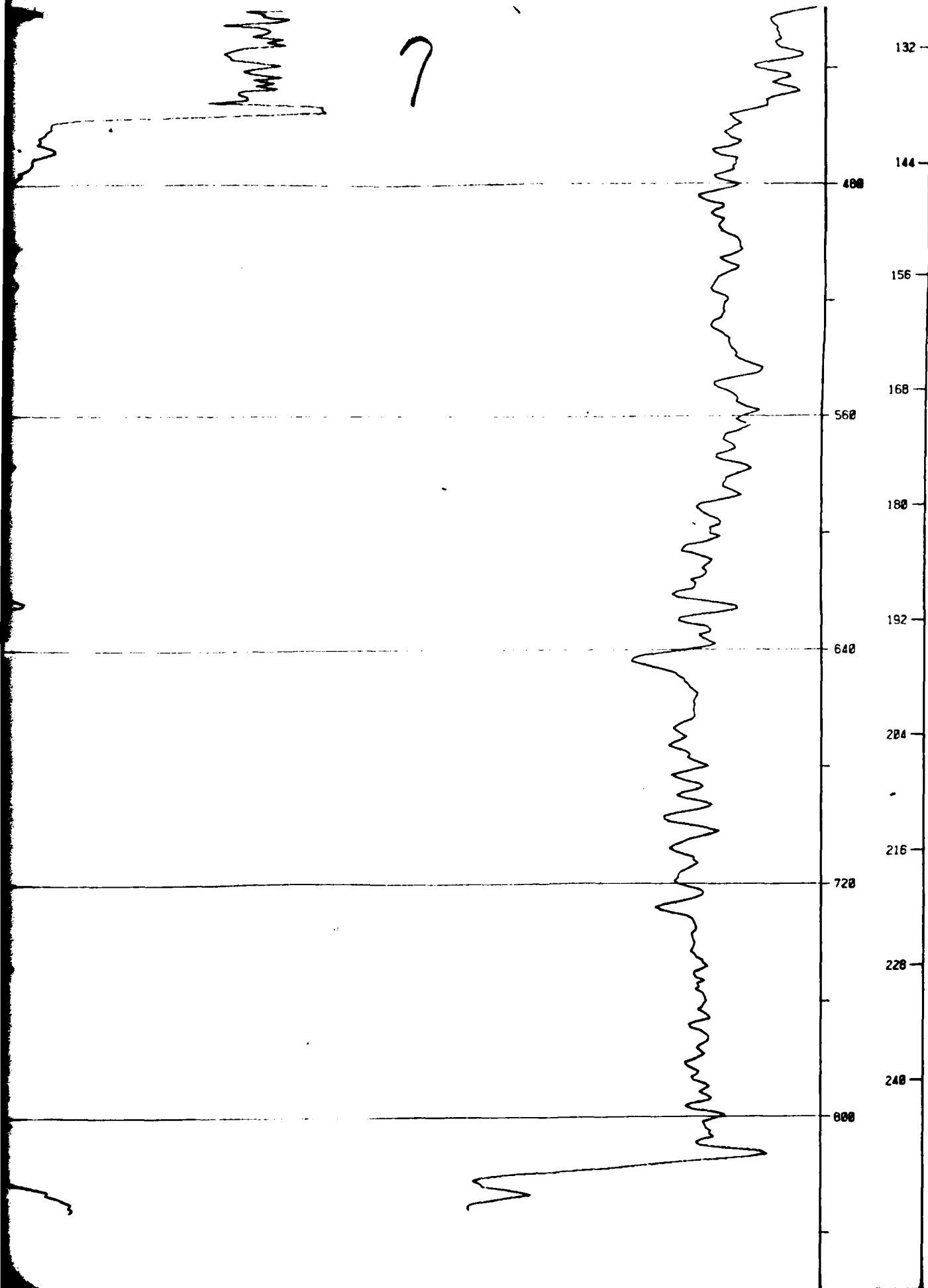
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1

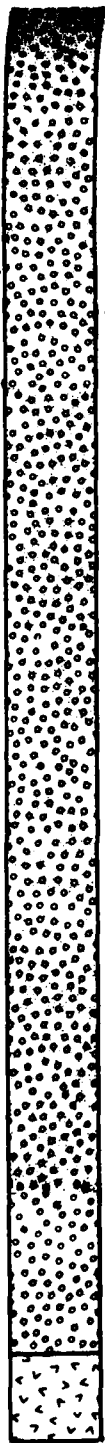


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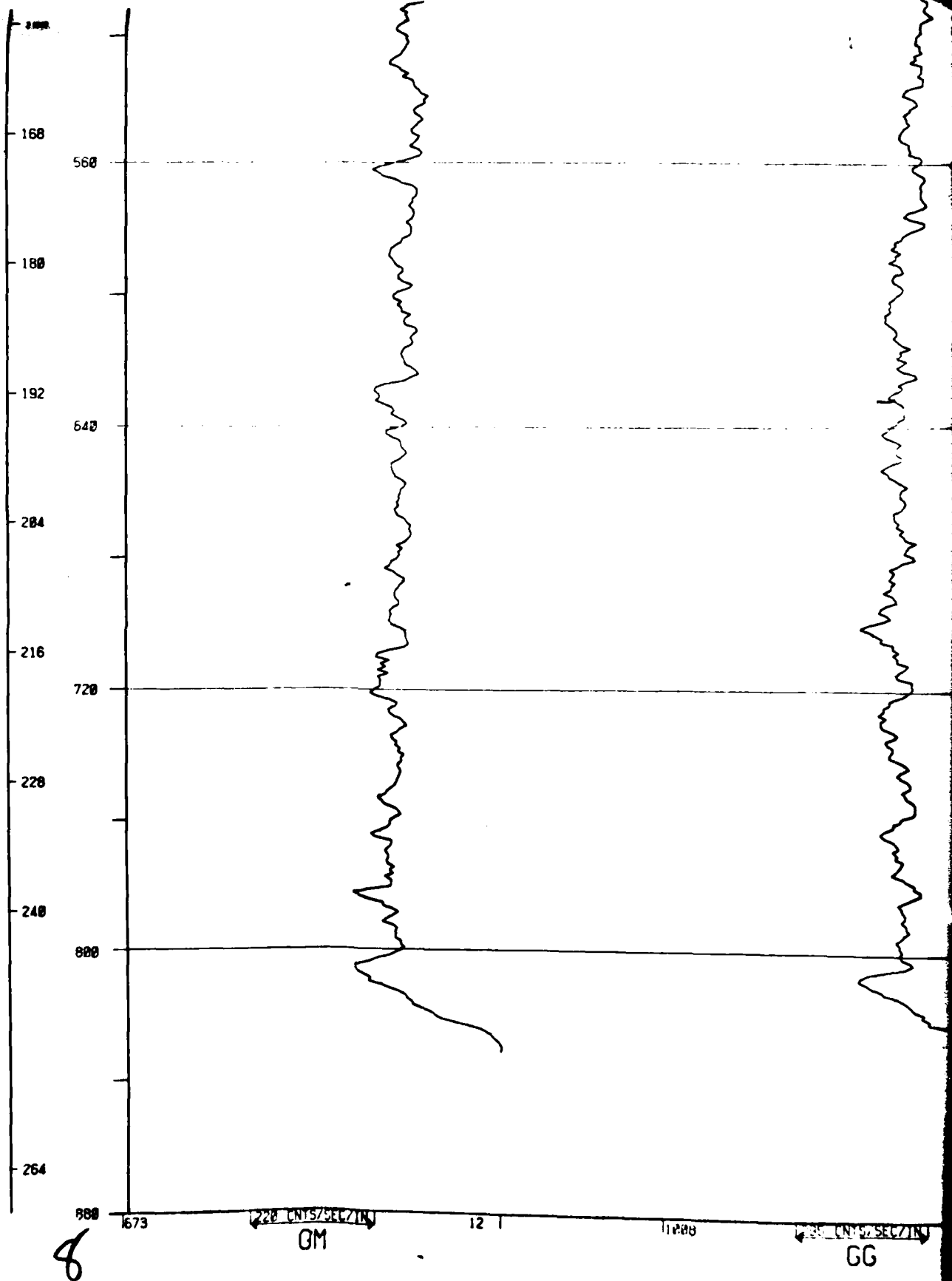
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8M



GM





124 I

2666

496 CNTS/SEC/IN

NG

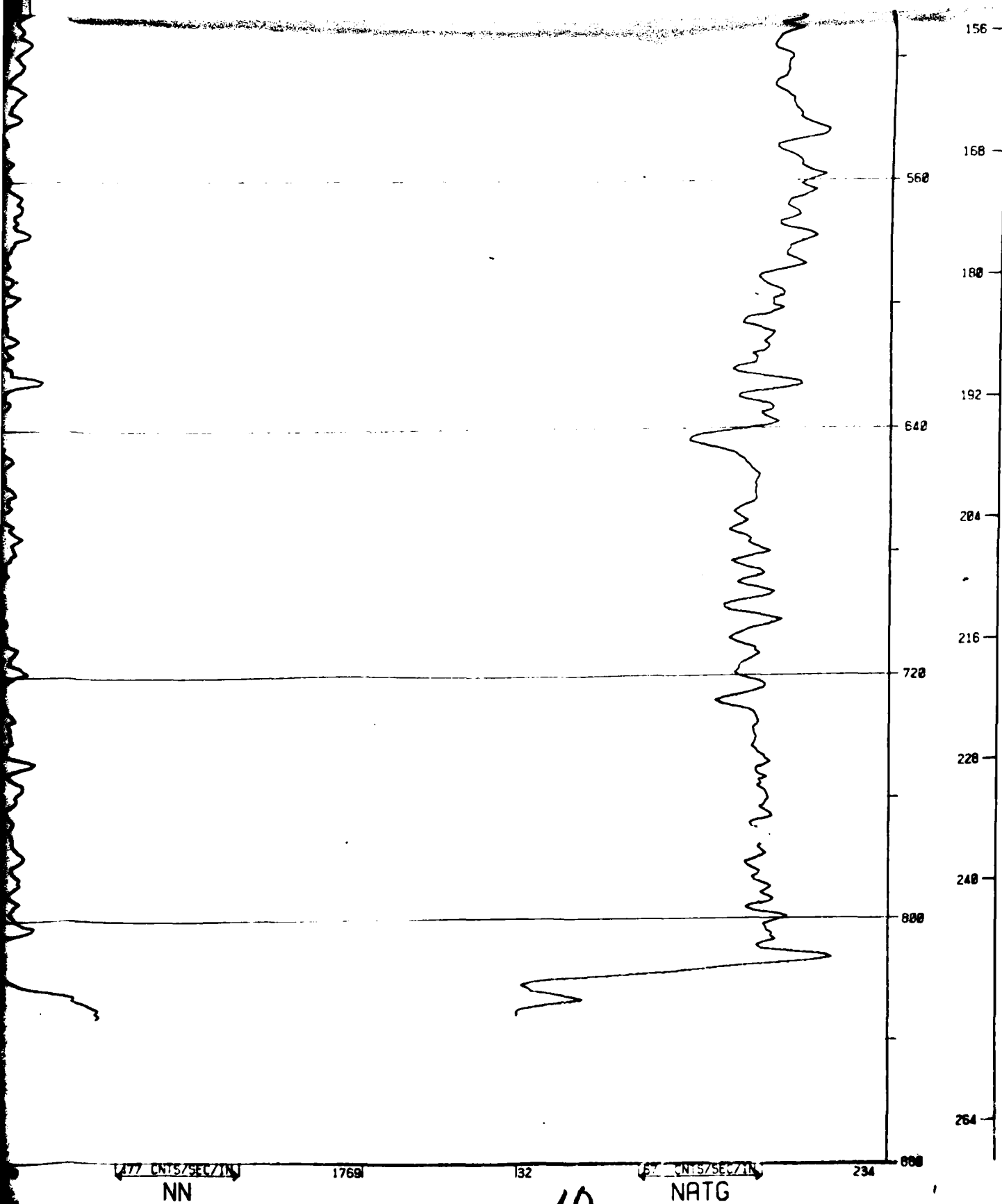
4153

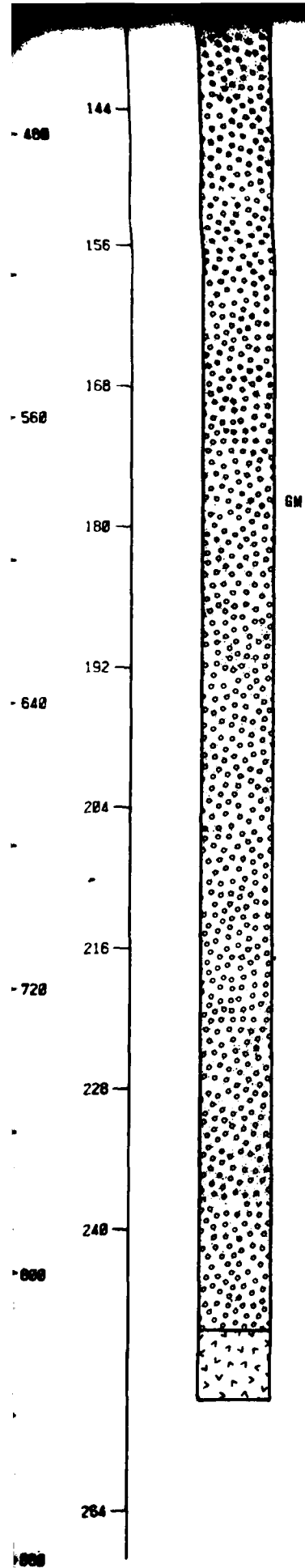
339

477 CNTS/SEC/IN

NN

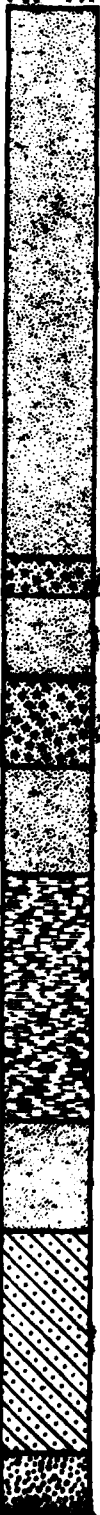
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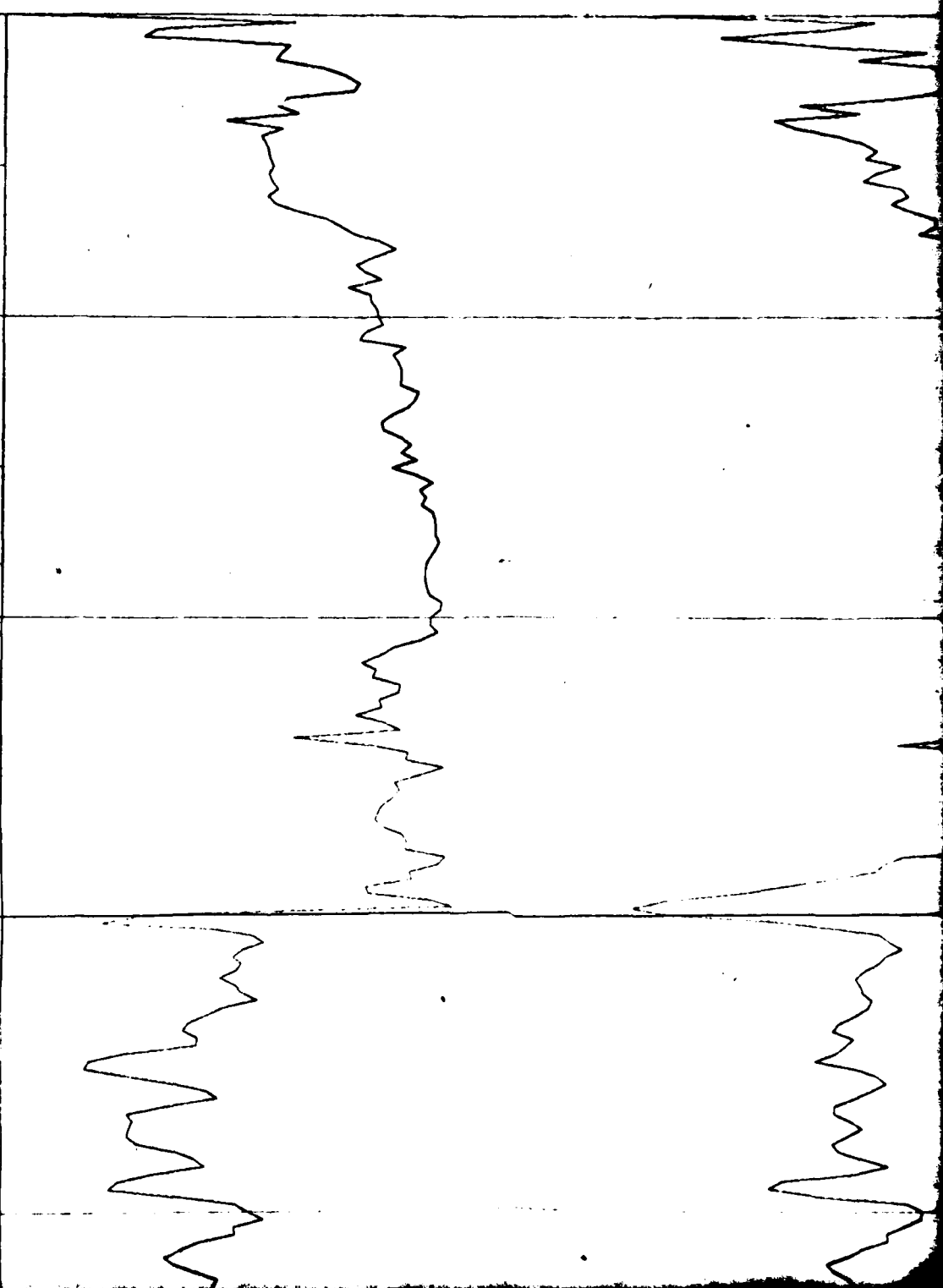
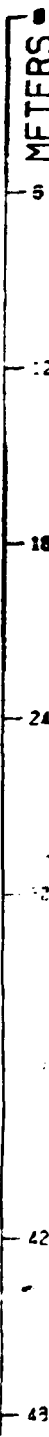
NUCLEAR GEOPHYSICAL LOGS BORING LD-3-2 LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANSO	DRAWING A-11
FURBER NATIONAL, INC.	

FN-TR-19

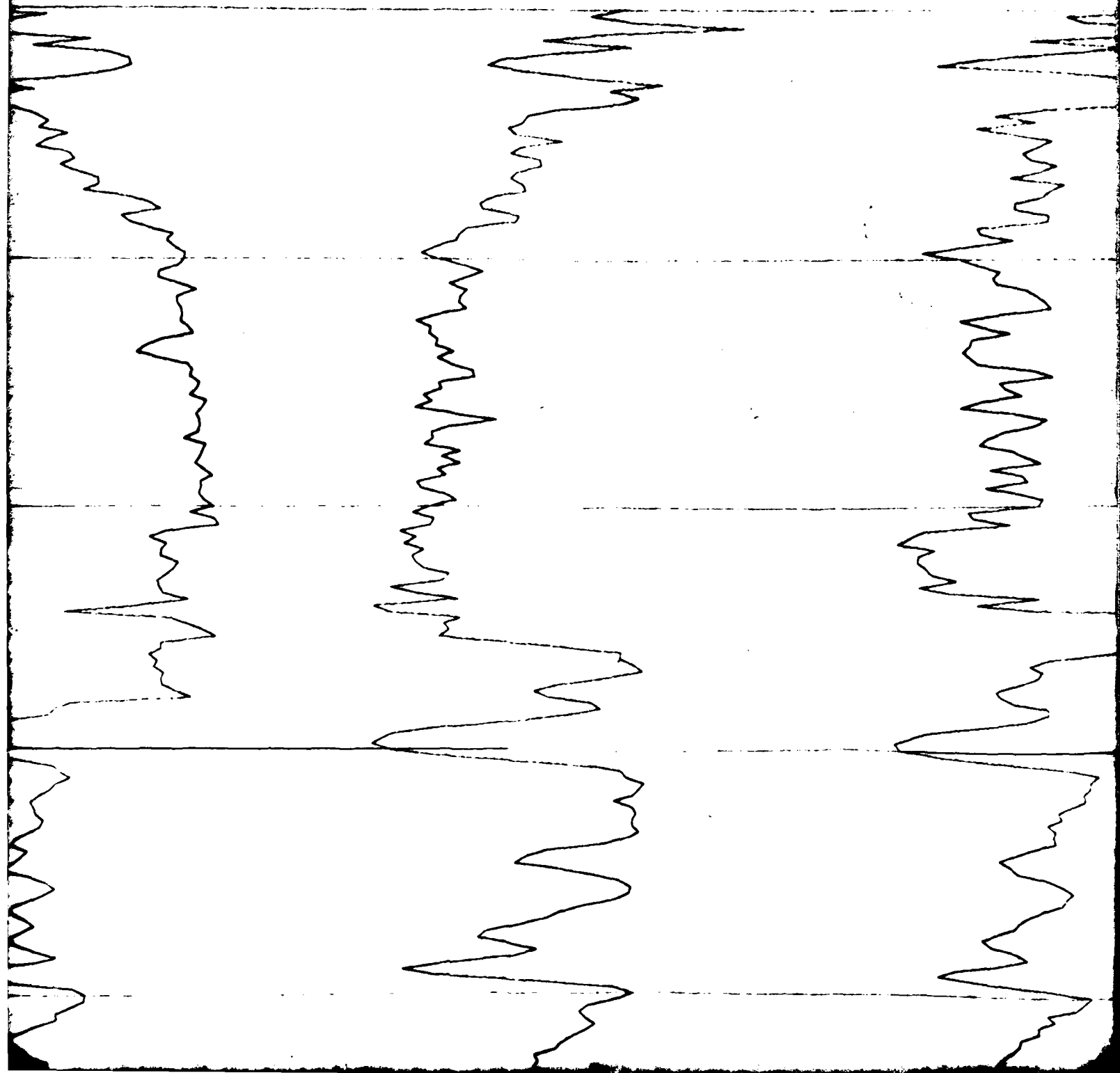


METERS

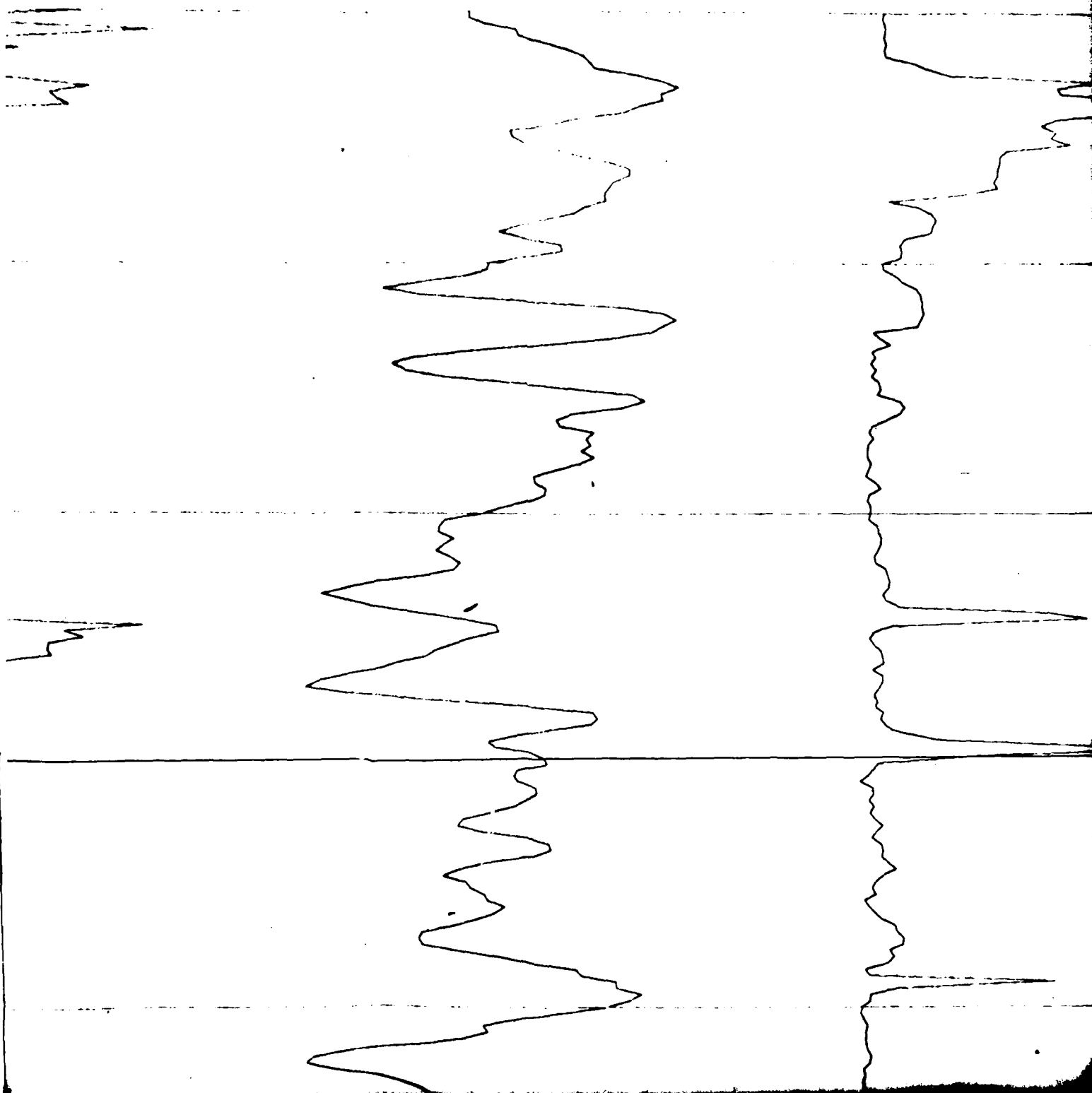
FEET



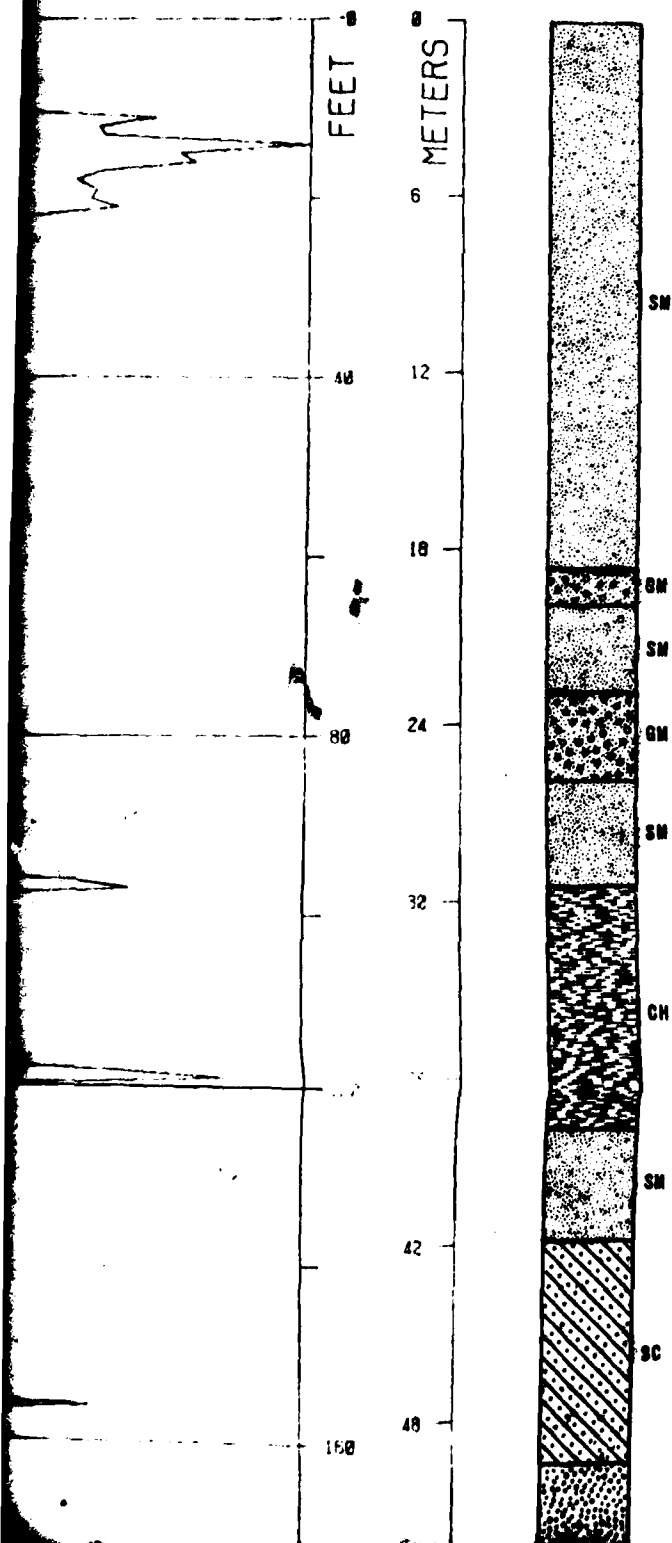
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4



WASHINGTON STATE UNIVERSITY

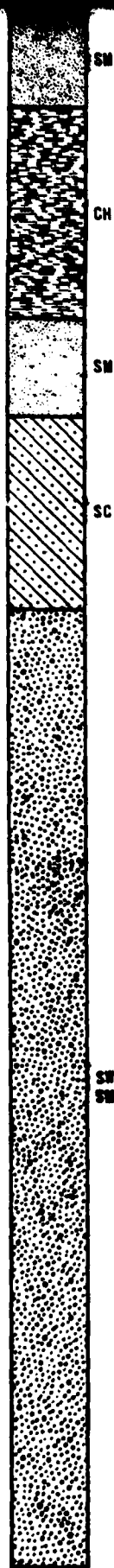
COLLEGE OF ENGINEERING

GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
BORING NO. LD-C-1
ELEVATION 540' (165m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 4/27/77
TOTAL DEPTH LOGGED . . 285' (87m)
DEPTH TO WATER LEVEL . ———
REMARKS ———

EXPLANATION
LOG TITLES
NATG - - - NATURAL GAMMA
GG - - - GAMMA GAMMA
NN - - - NEUTRON NEUTRON
NG - - - NEUTRON GAMMA
FT - - - FLUID TEMPERATURE
RA - - - FLUID RESISTIVITY
CALP - - - CALIPER
SP - - - SPONTANEOUS POTENTIAL
WRES - - - RESISTIVITY
FMTA - - - FLOW METER
GM - - - DELTA GAMMA

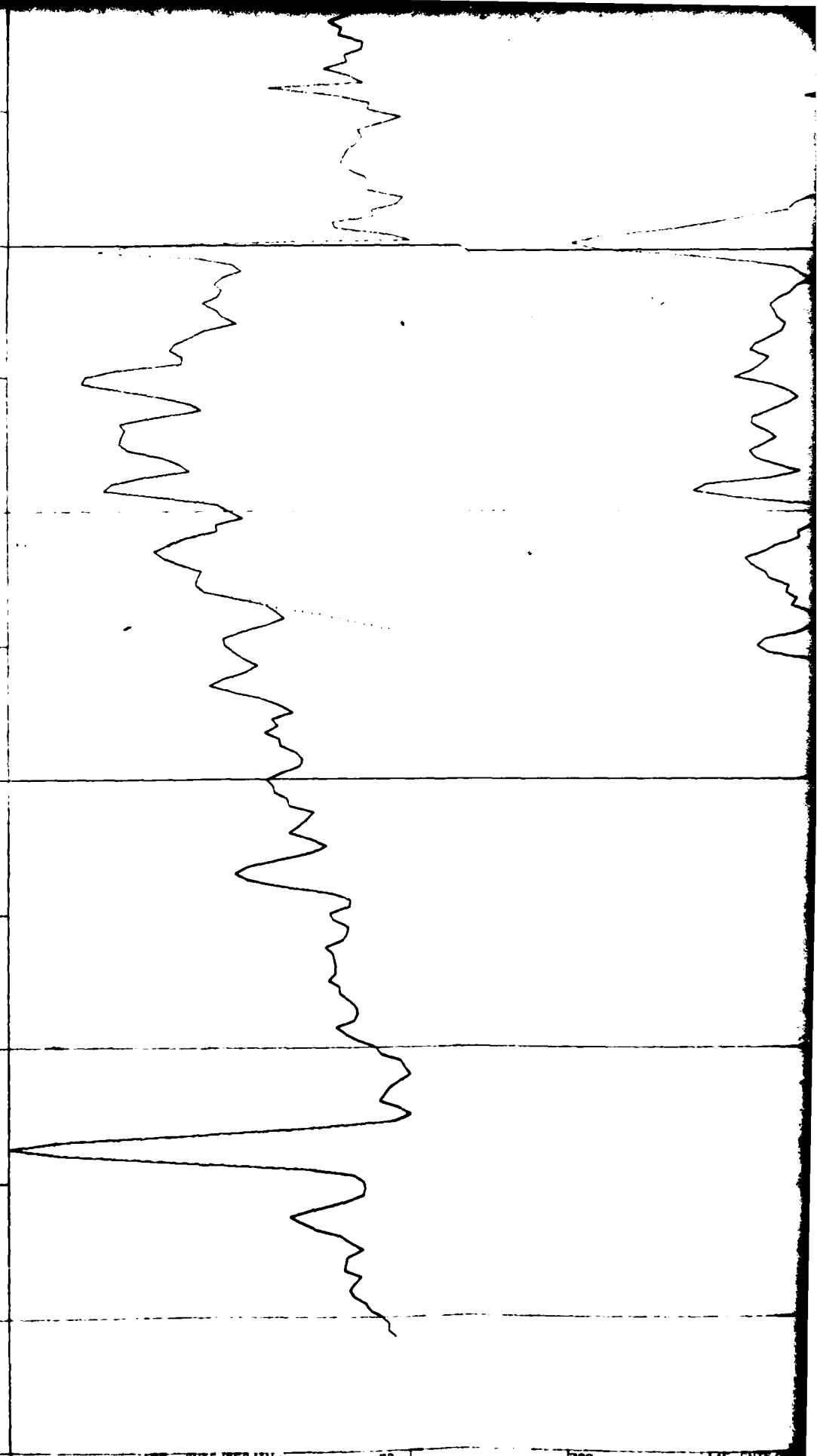
DENSITY LOG-LOG INCREASES →
POROSITY LOG-LOG INCREASES ←
WATER LEVEL - - - - -



SM
CH
SM
SC
SM/SH

40
42
43
44
60
66
72
78
84
90

160
220
240
280



283

170 CNTS/SEC/IN

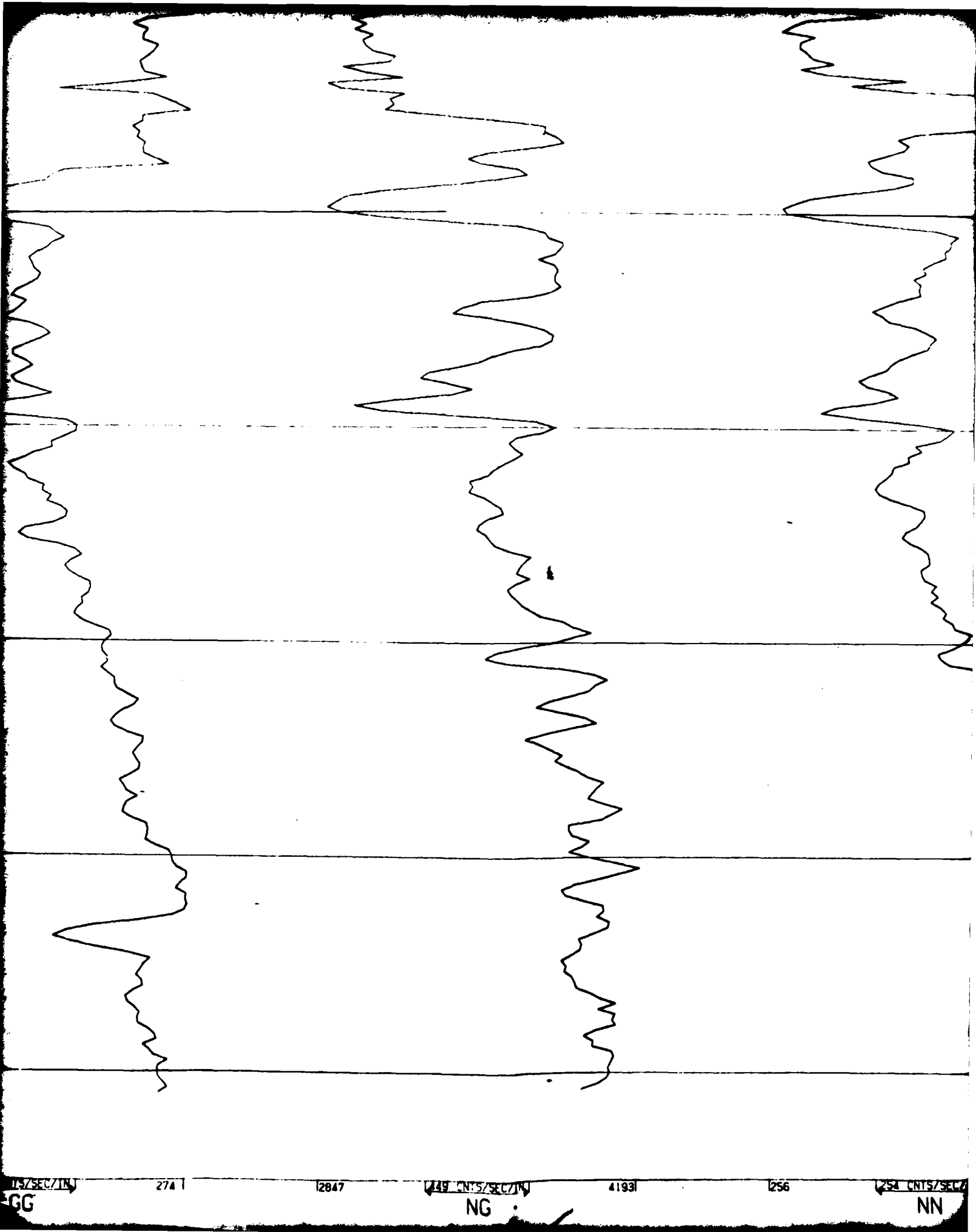
GM

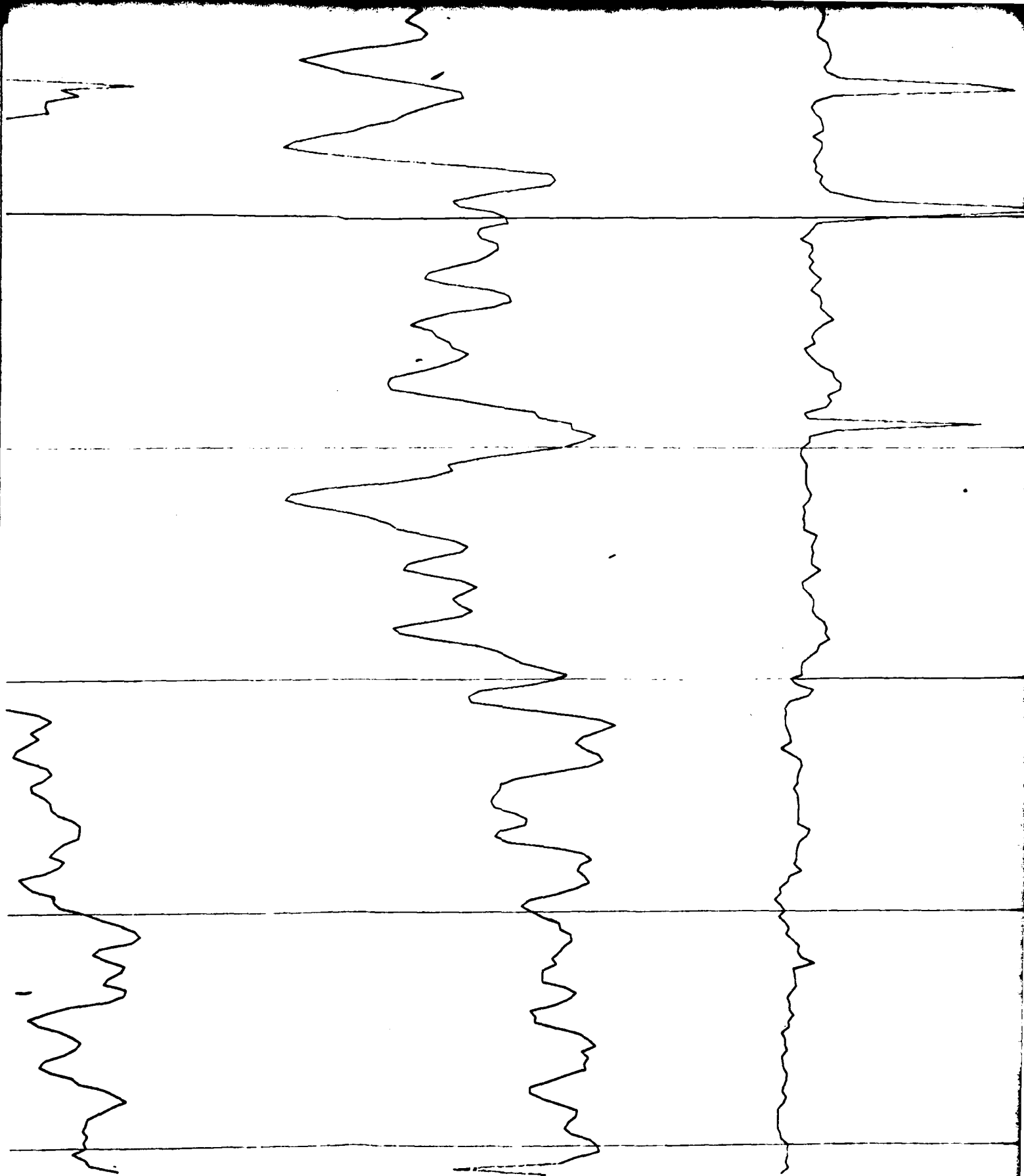
73

1700

145 CNTS/SEC

GG





1019

1120

125 CNTS/SEC/IN

NATG

196

55/8" CALP

TOTAL DEPTH LOGGED . . . 285'

DEPTH TO WATER LEVEL . . .

REMARKS

EXPLANATION

LOG TITLES

NATG - - - NATURAL GAMMA
GG - - - GAMMA GAMMA
NN - - - NEUTRON NEUTRON
NG - - - NEUTRON GAMMA
FT - - - FLUID TEMPERATURE
FR - - - FLUID RESISTIVITY
CALP - - - CALIPER
SP - - - SPONTANEOUS POTENTIAL
WRES - - - RESISTIVITY
FMTR - - - FLOW METER
GM - - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →

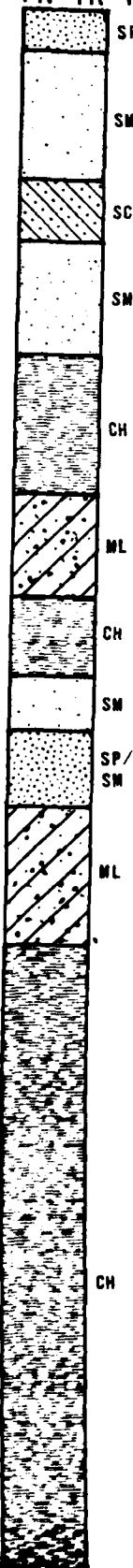
POROSITY (NN-LOG) INCREASES ←

WATER LEVEL - - -

NUCLEAR GEOPHYSICAL LOGS	
BORING 10-C-1	
TECHUCUTLE DESERT, ARIZONA	
MX SITING INVESTIGATION	Swiford
DEPARTMENT OF THE AIR FORCE - SAMSO	A-4
FURBER NATIONAL INC.	

8

FN-TR-19



METERS

FEET

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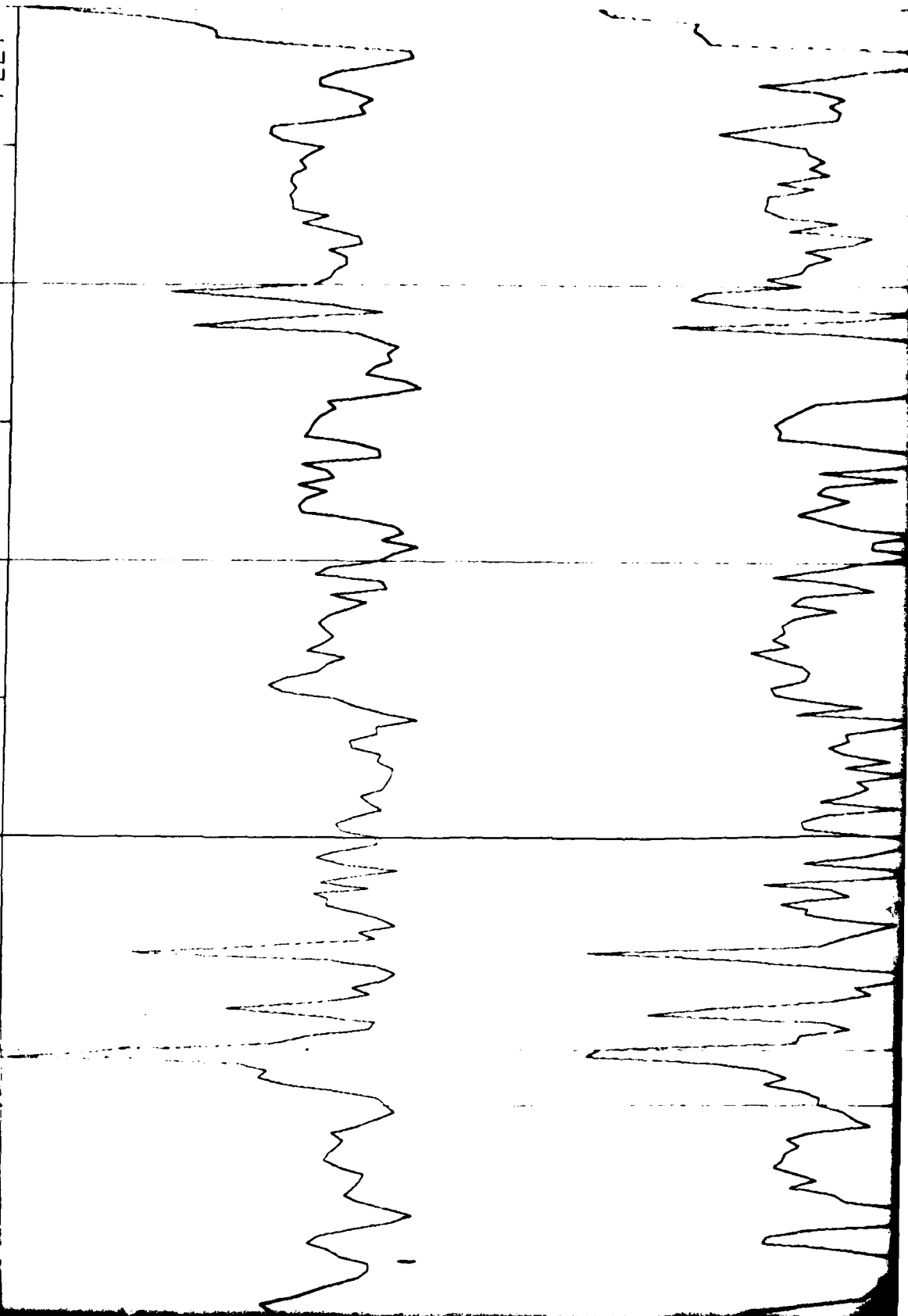
32

48

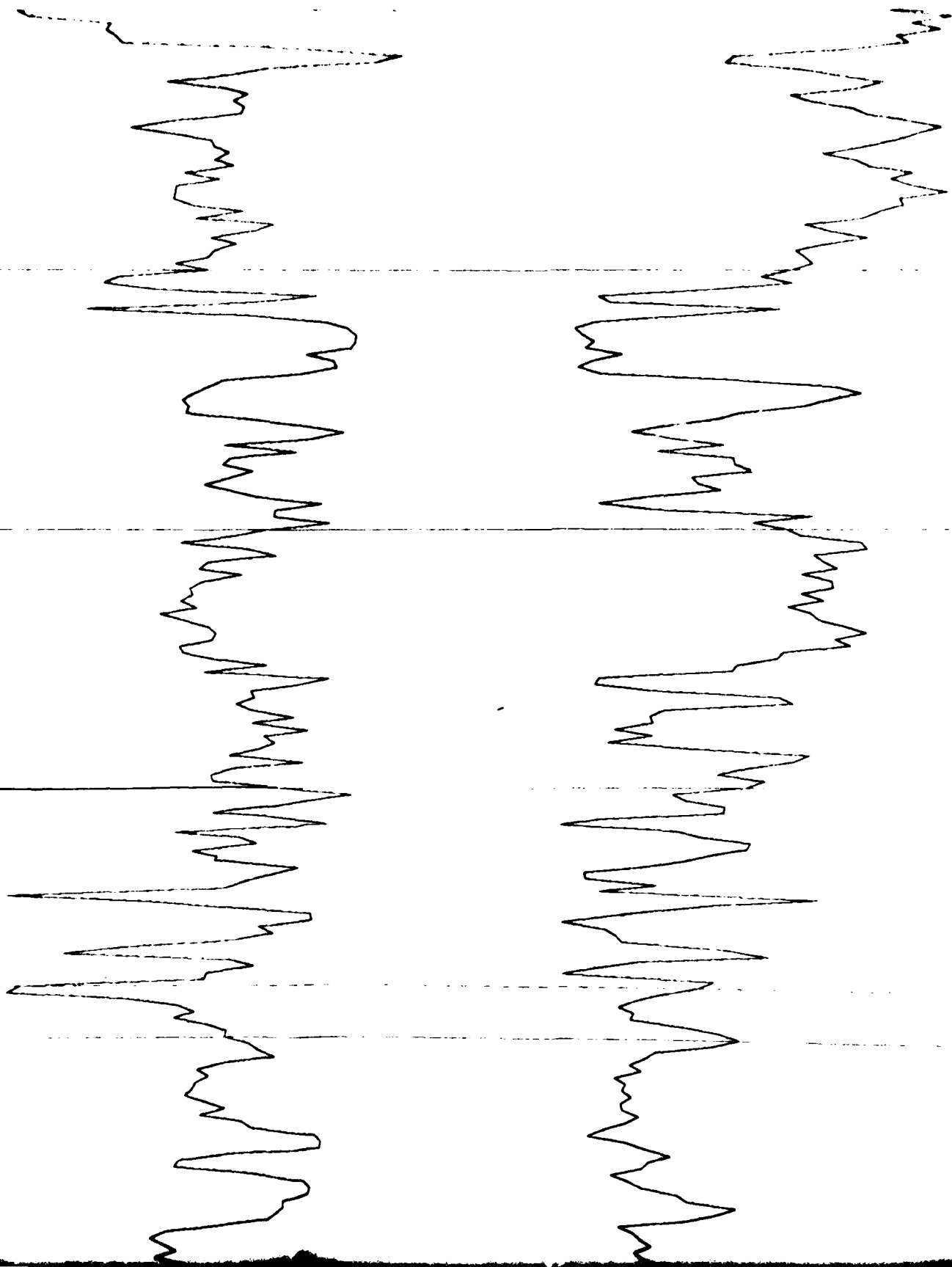
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160

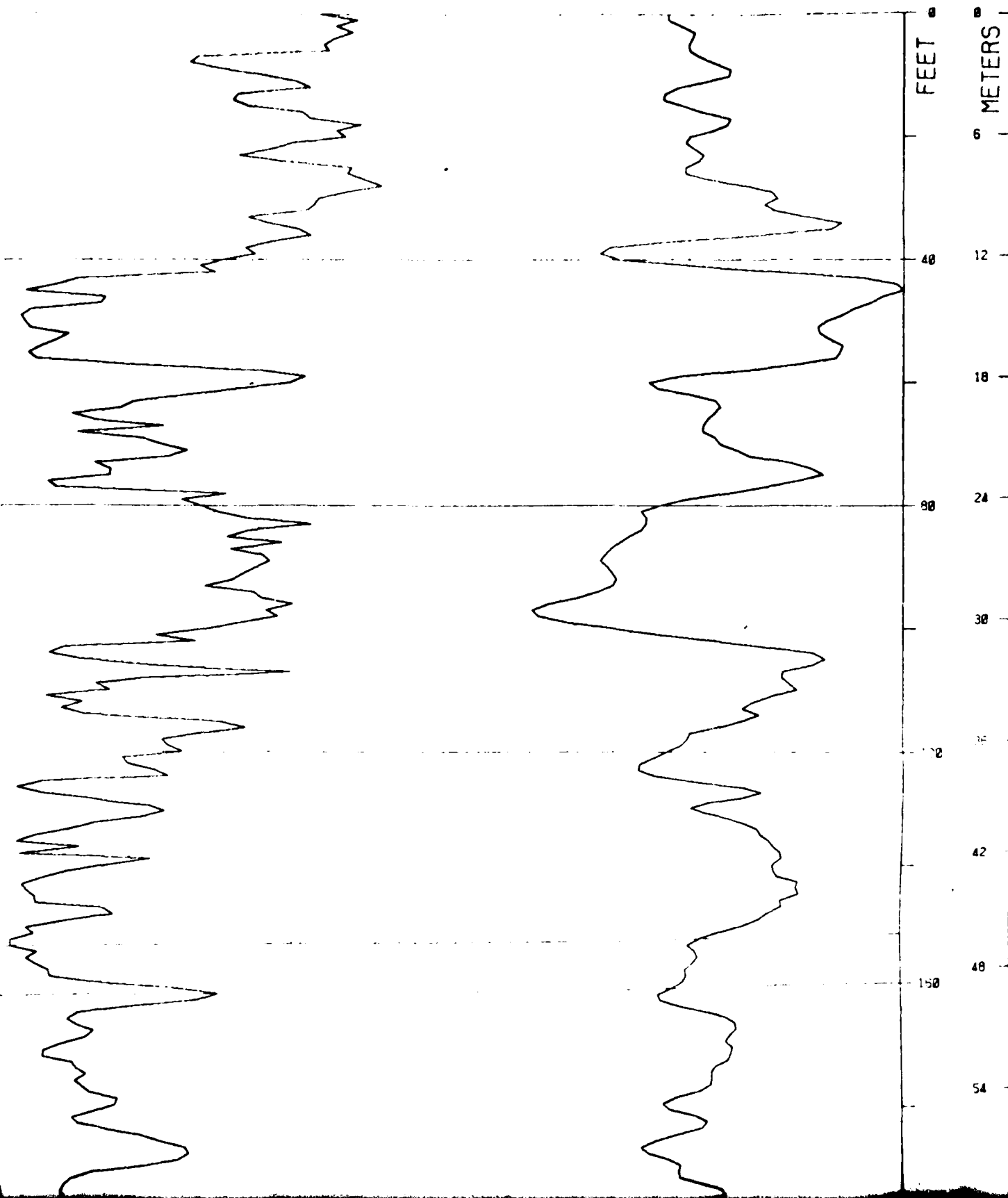
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2



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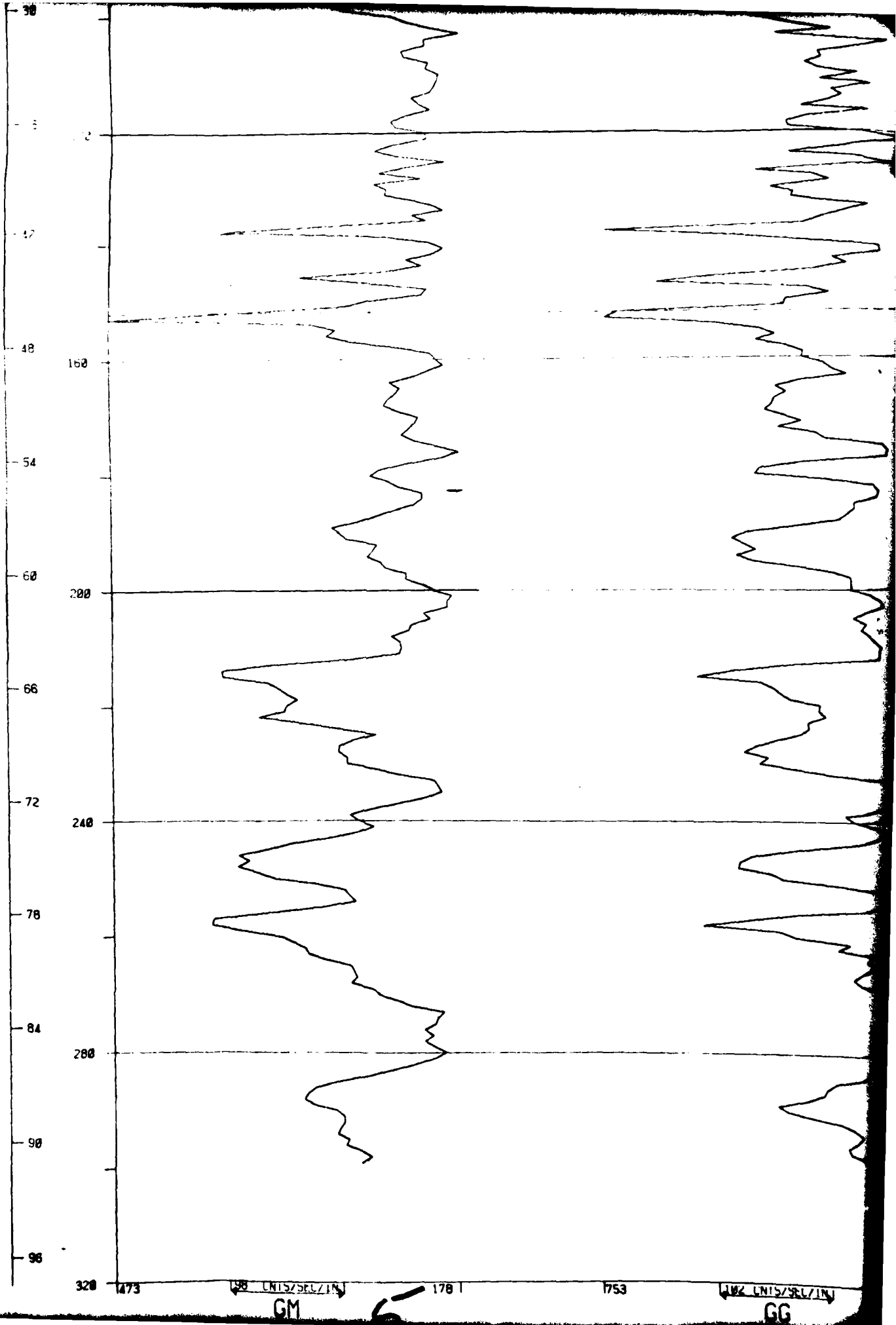
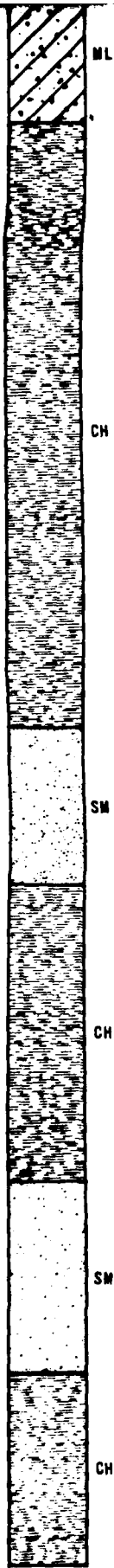


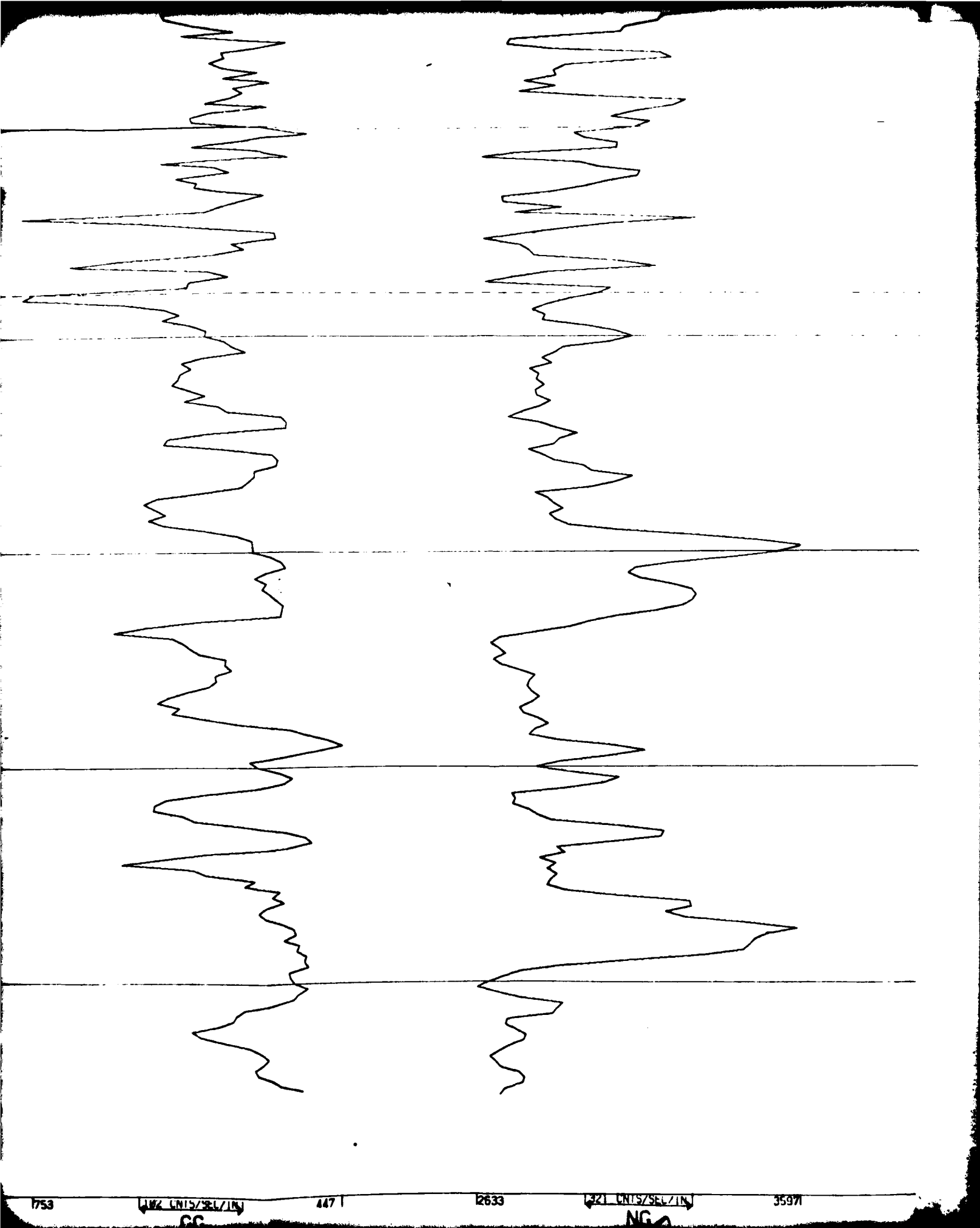
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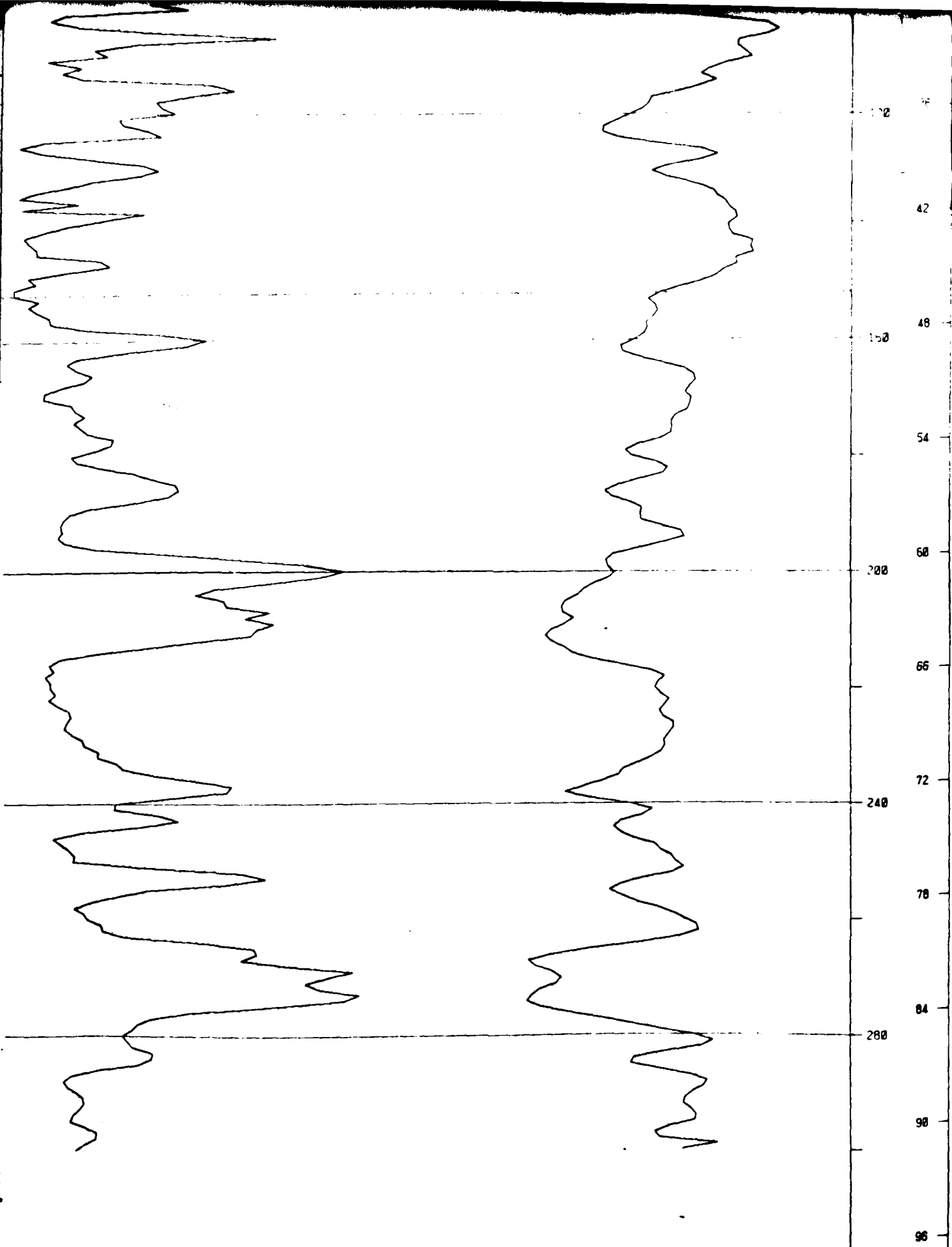
GEOHYDROLOGY SECTION
WELL LOG PROCESSING SYSTEM

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PROJECT NAME . . . . . AIR FORCE
BORING NO. . . . . LD-C-2
ELEVATION . . . . . 490' (149m)
STATE . . . . . ARIZONA
COUNTY . . . . . YUMA
STUDY AREA . . . . . LECHUGUILLA DES.
DATE LOGGED . . . . . 5/05/77
TOTAL DEPTH LOGGED . . 301' (92m)
DEPTH TO WATER LEVEL . 153' (47m)
REMARKS . . . . . _____
```

LOG FILES	EXPLANATION
NO10	NATURAL CRACKS
NO00	CRACKS IN JOINTS
NO01	CRACKS IN JOINTS
NO02	CRACKS IN JOINTS
NO03	CRACKS IN JOINTS
NO04	CRACKS IN JOINTS
NO05	CRACKS IN JOINTS
NO06	CRACKS IN JOINTS
NO07	CRACKS IN JOINTS
NO08	CRACKS IN JOINTS
NO09	CRACKS IN JOINTS
NO11	CRACKS IN JOINTS
NO12	CRACKS IN JOINTS
NO13	CRACKS IN JOINTS
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NO97	CRACKS IN JOINTS
NO98	CRACKS IN JOINTS
NO99	CRACKS IN JOINTS







231

UNIT/SEC/IN

NN

560

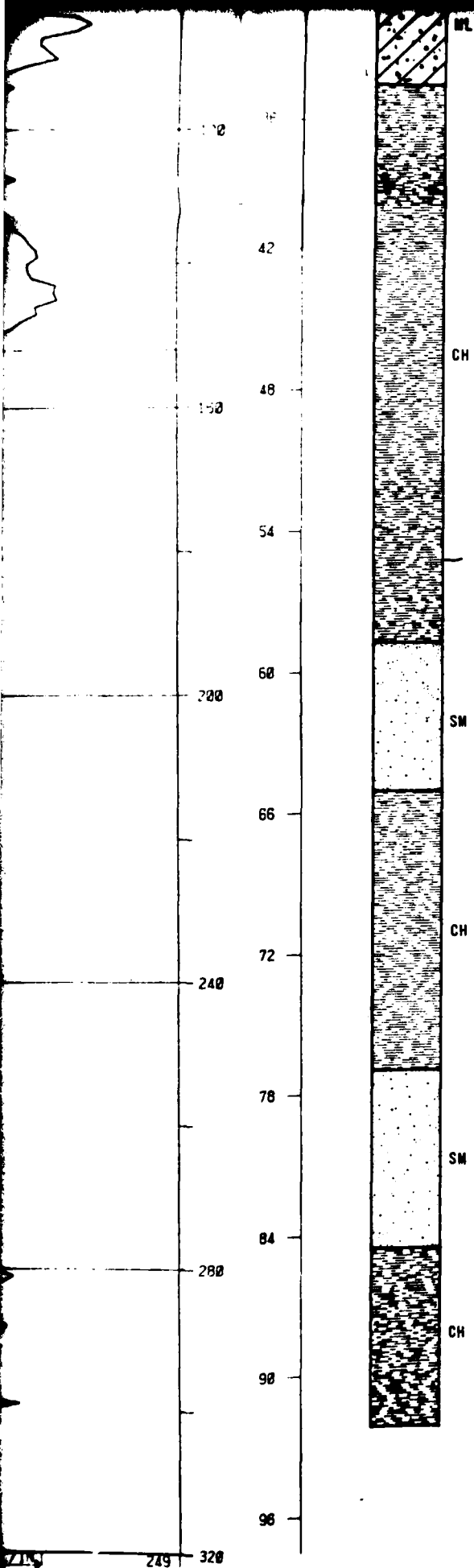
1134

UNIT/SEC/IN

NATG

249

320



EXPLANATION

LOG TITLES
 ML - MUD LOG
 CH - CHALK
 SM - SANDSTONE
 NN - NEUTRON LOG
 NG - NEUTRON LOG
 AT - APPARENT RESISTIVITY
 FR - TRUE RESISTIVITY
 ROP - RESISTIVITY
 SP - SPONTANEOUS POTENTIAL
 ARS - RESISTIVITY
 CM - CEMENT LOG
 SM - SLOPE LOG

DENSITY - INCREASES →
 POROSITY - INCREASES ←
 WATER LEVEL -

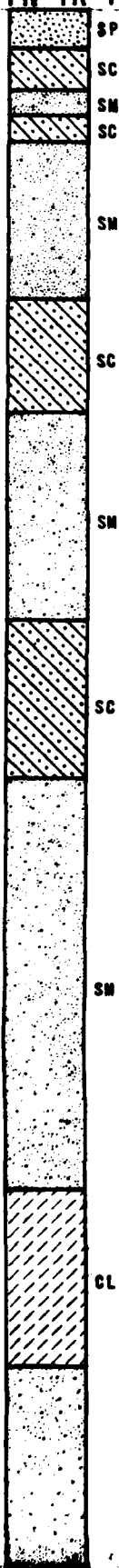
NUCLEAR GEOPHYSICAL LOGS
 BORING LD-C-2
 LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
 DEPARTMENT OF THE AIR FORCE - SANSO

DRAWING
 A-5

FUSCO NATIONAL INC.

FN-TR-19



METERS

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42

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54

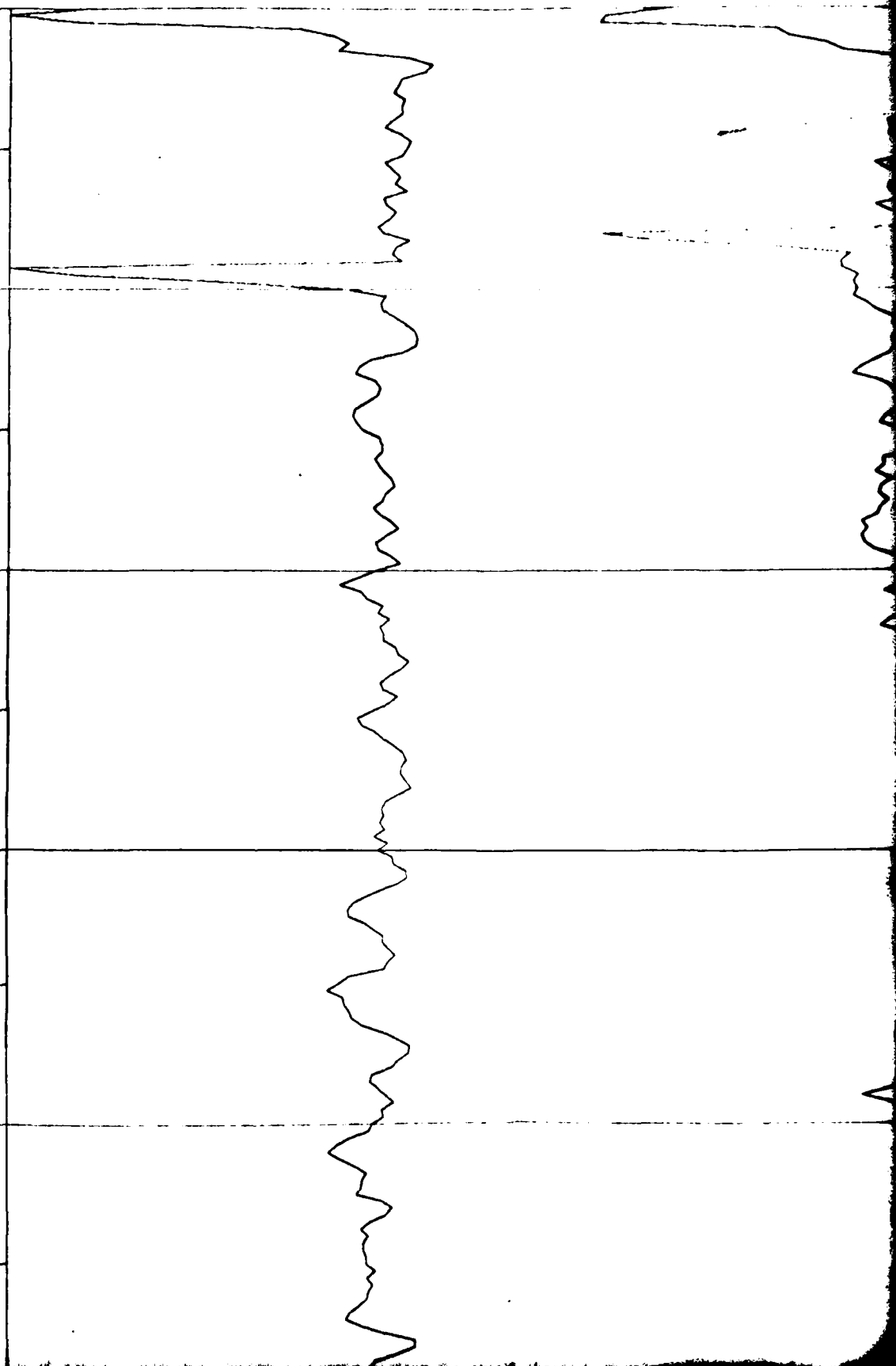
FEET

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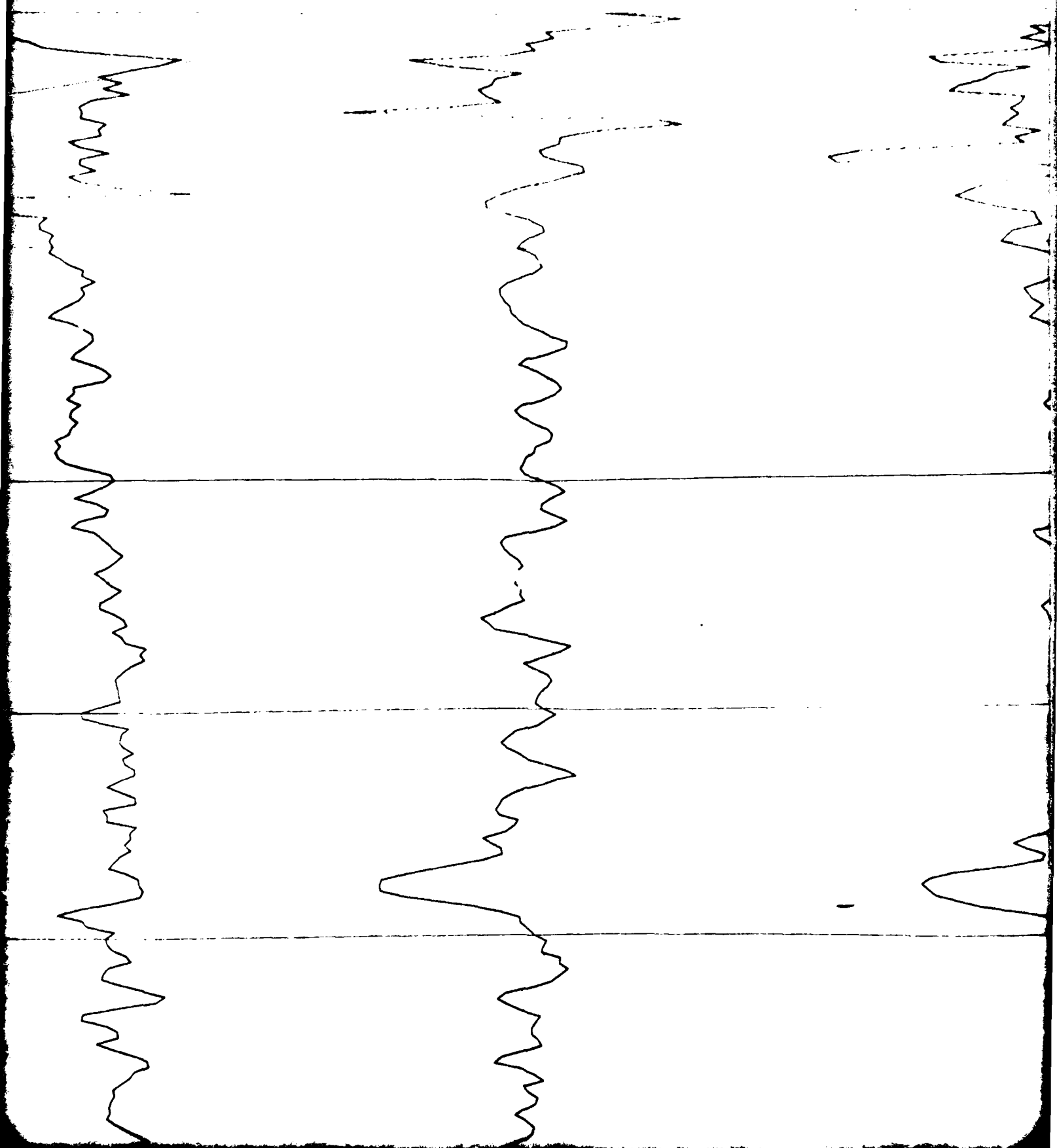
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160

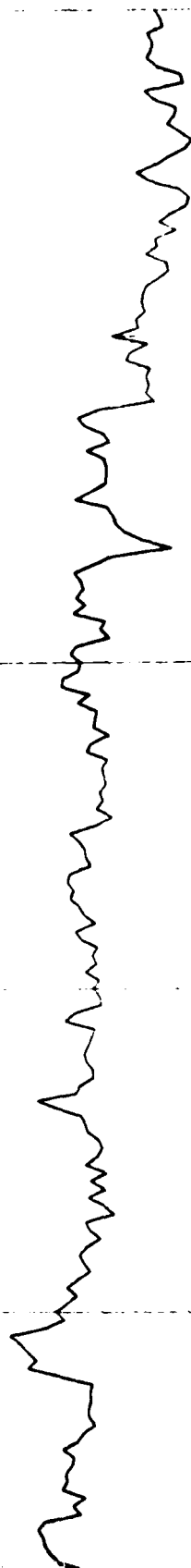
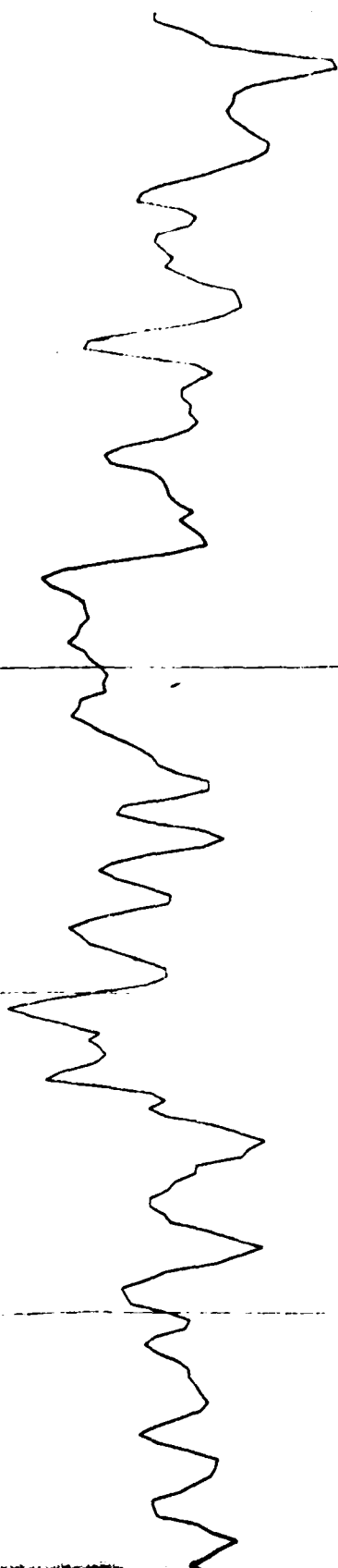


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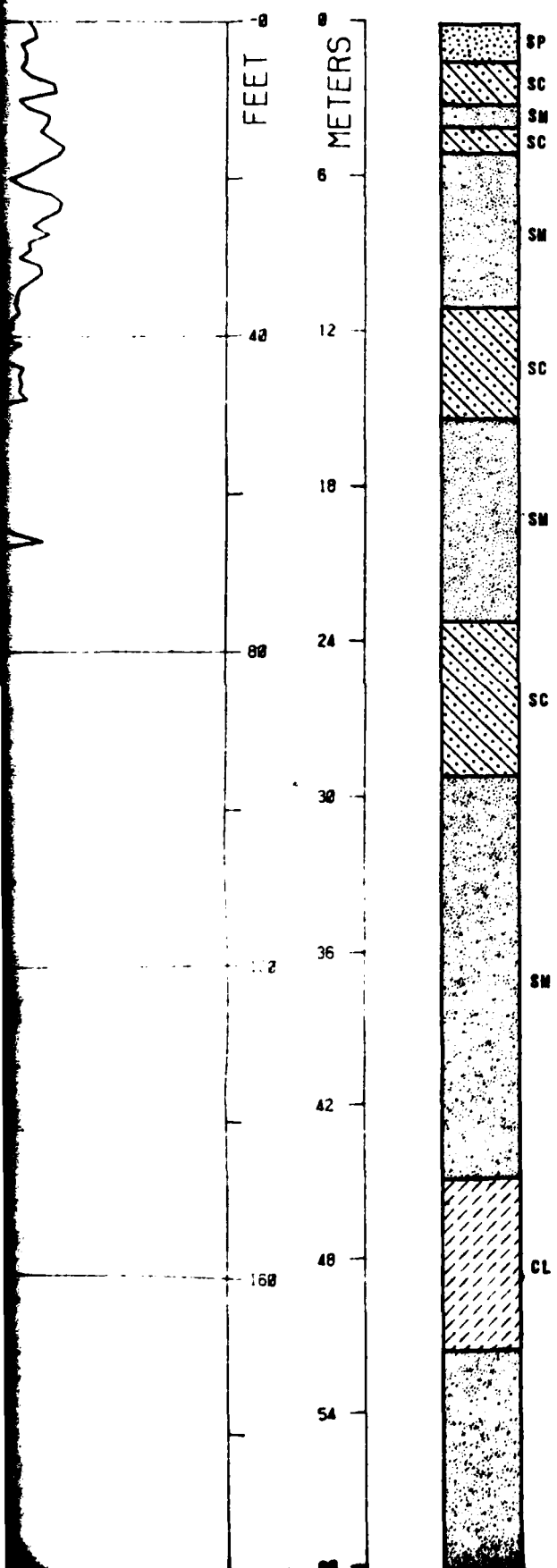


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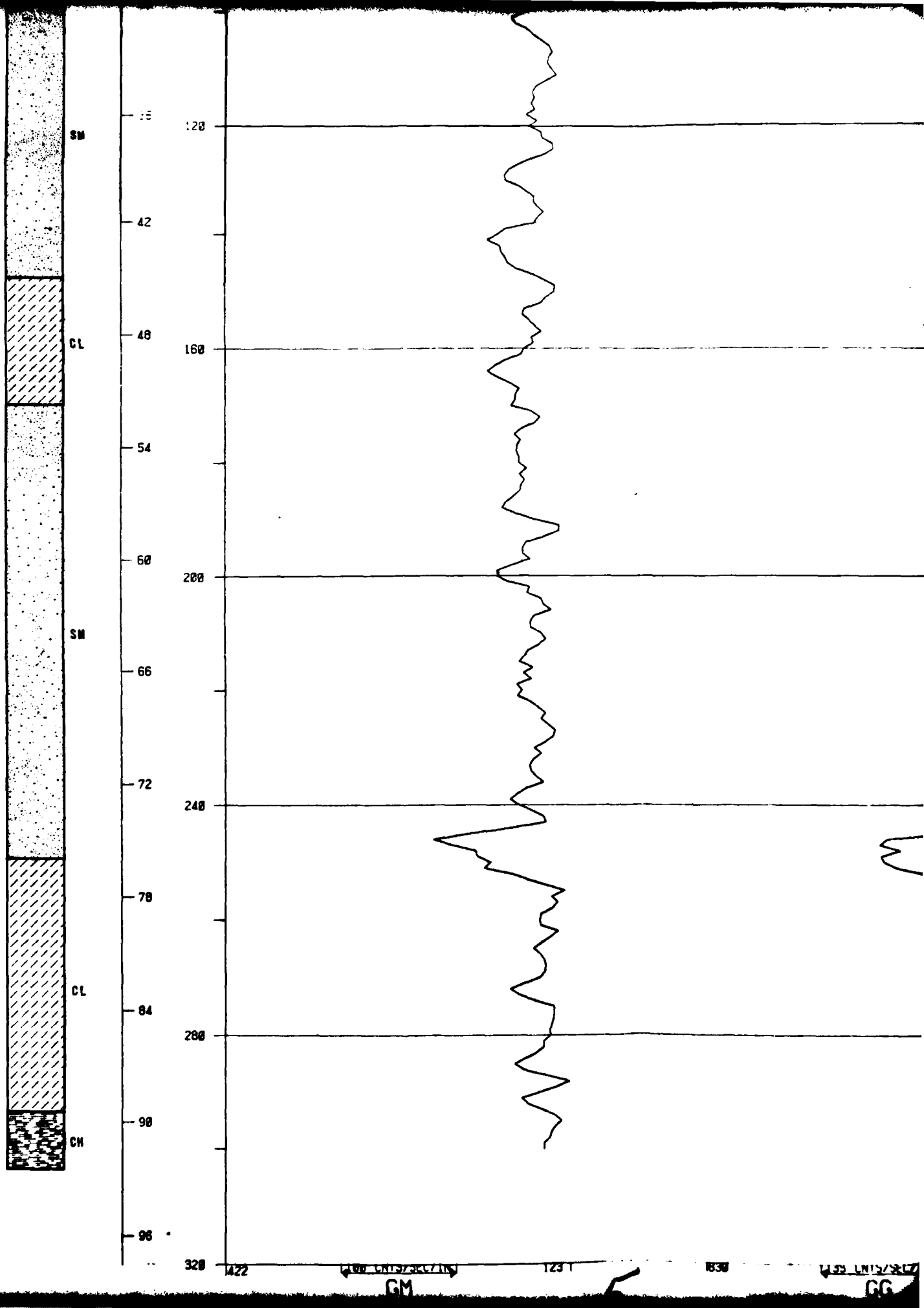
WASHINGTON STATE UNIVERSITY COLLEGE OF ENGINEERING

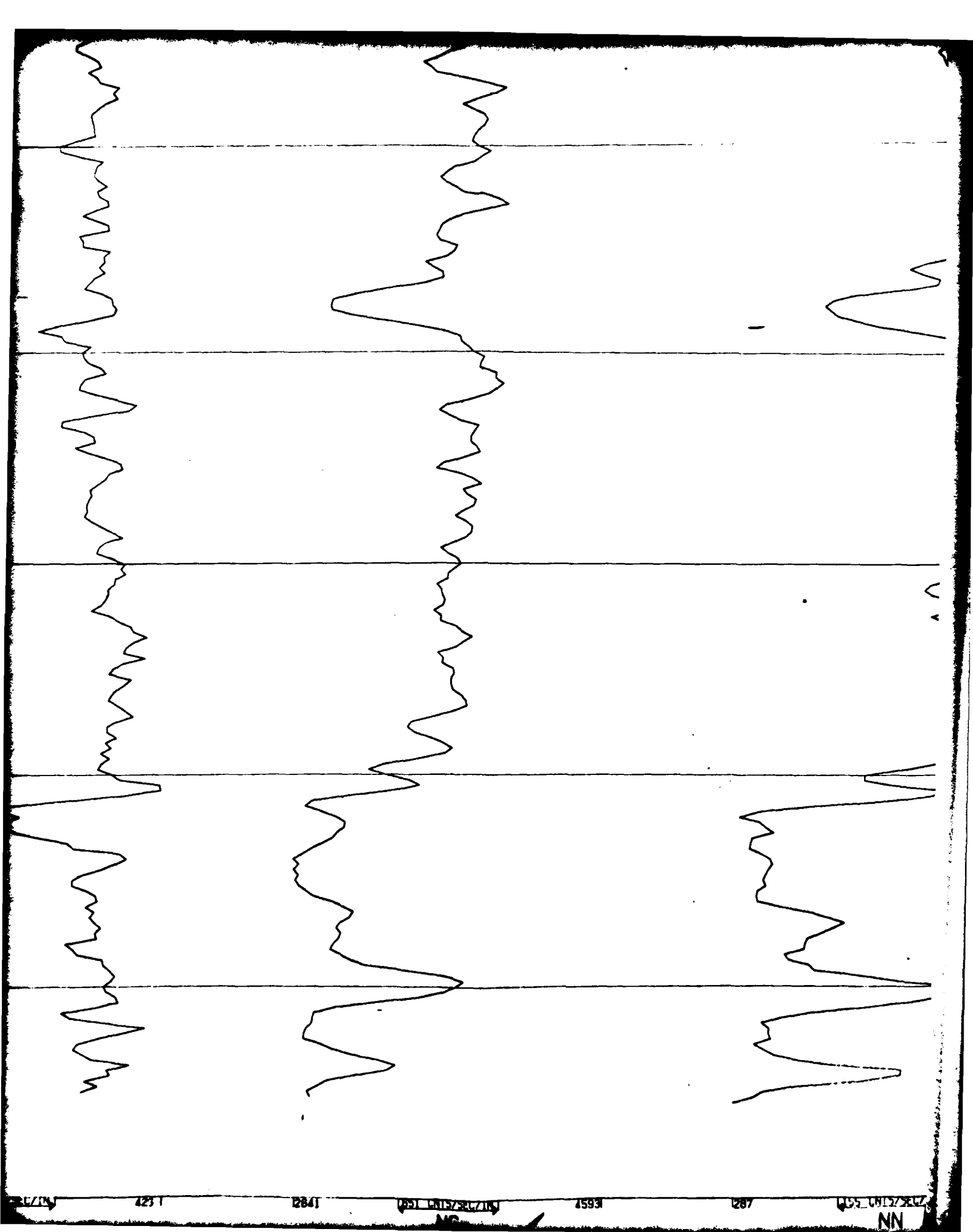
GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

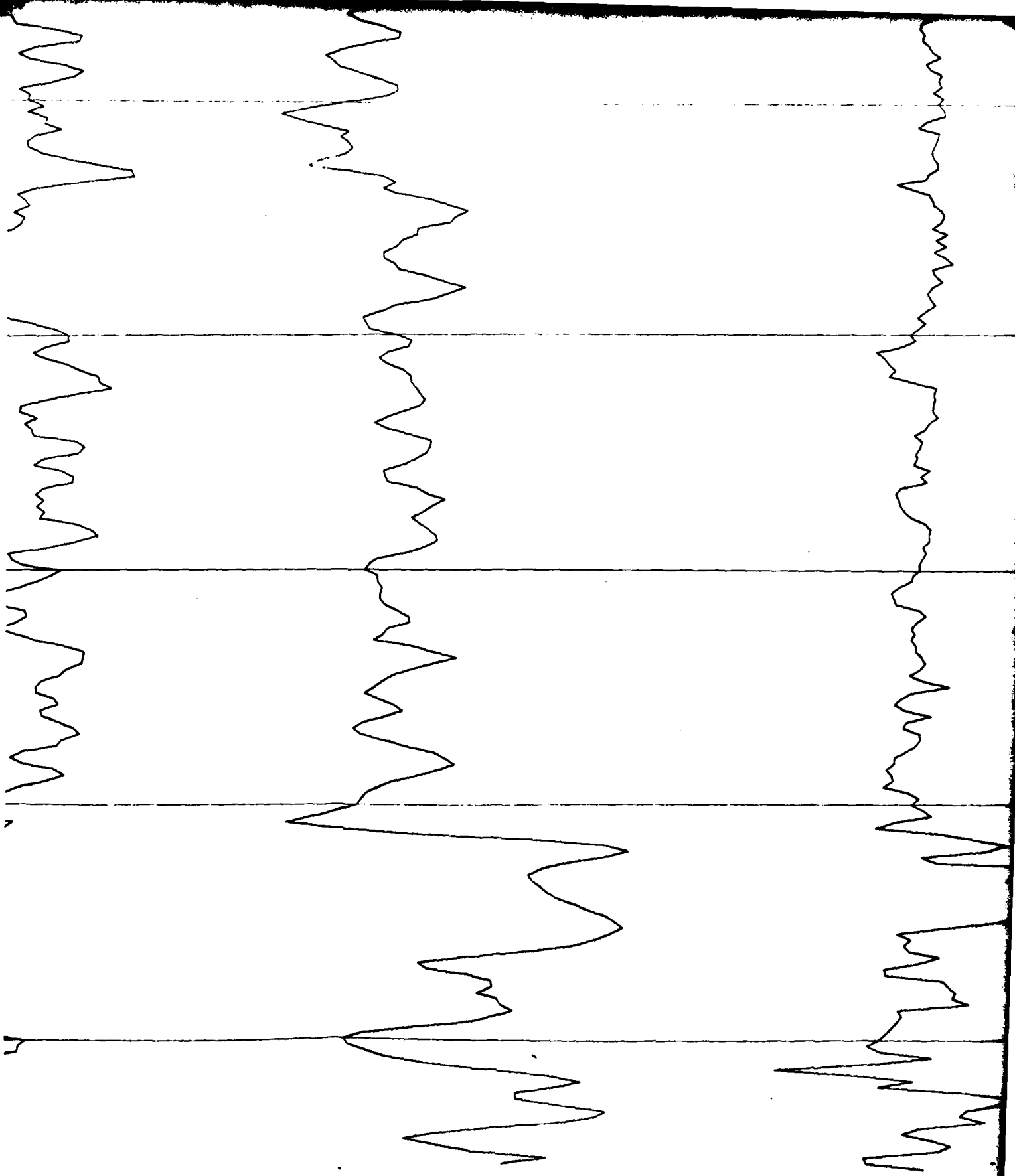
PROJECT NAME AIR FORCE
BORING NO. LD-C-3
ELEVATION 700' (213m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/6/77
TOTAL DEPTH LOGGED . . 302' (92m)
DEPTH TO WATER LEVEL . ———
REMARKS ———

EXPLANATION
LOG TITLES
NATG - - - NATURAL GAMMA
GG - - - GAMMA GAMMA
NN - - - NEUTRON NEUTRON
NG - - - NEUTRON GAMMA
FT - - - FLUID TEMPERATURE
FR - - - FLUID RESISTIVITY
CALP - - - CALIPER
SP - - - SPONTANEOUS POTENTIAL
WRES - - - RESISTIVITY
FMTR - - - FLOW METER
GM - - - DELTA GAMMA

DENSITY LOG LOG INCREASES →
POROSITY (NN LOG) INCREASES ←
WATER LEVEL - - - -







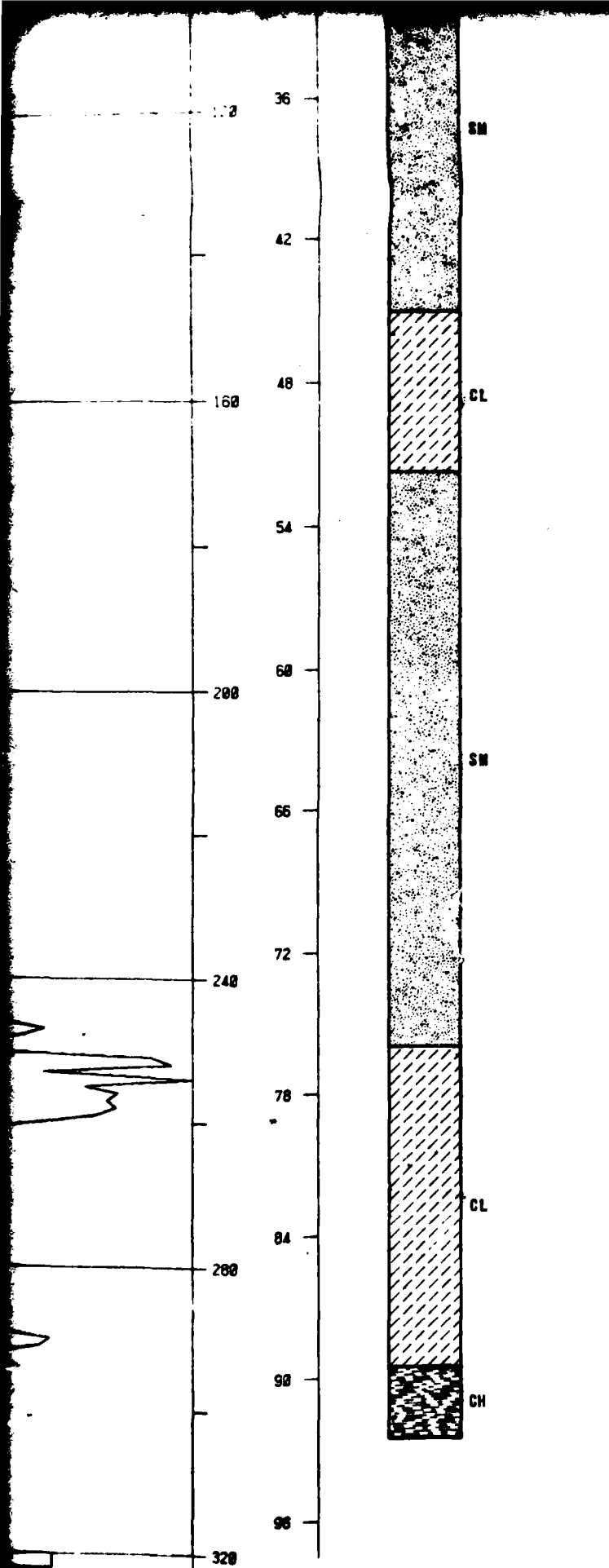
751

1132

127 CNTS/SEC/IN
NATG

212

4 7/8" CALP



- EXPLANATION
- LOG TITLES
- NATG - - - NATURAL GAMMA
 - GC - - - GAMMA GAMMA
 - NN - - - NEUTRON NEUTRON
 - NG - - - NEUTRON GAMMA
 - FT - - - FLUID TEMPERATURE
 - FR - - - FLUID RESISTIVITY
 - CALP - - - CALIPER
 - SP - - - SPONTANEOUS POTENTIAL
 - WRES - - - RESISTIVITY
 - FMTB - - - FLOW METER
 - GM - - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →

POROSITY (NN-LOG) INCREASES ←

WATER LEVEL - - -

NUCLEAR GEOPHYSICAL LOGS BORTING LB-C-3 LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANSO	A-6
FUERO NATIONAL INC.	

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METERS -

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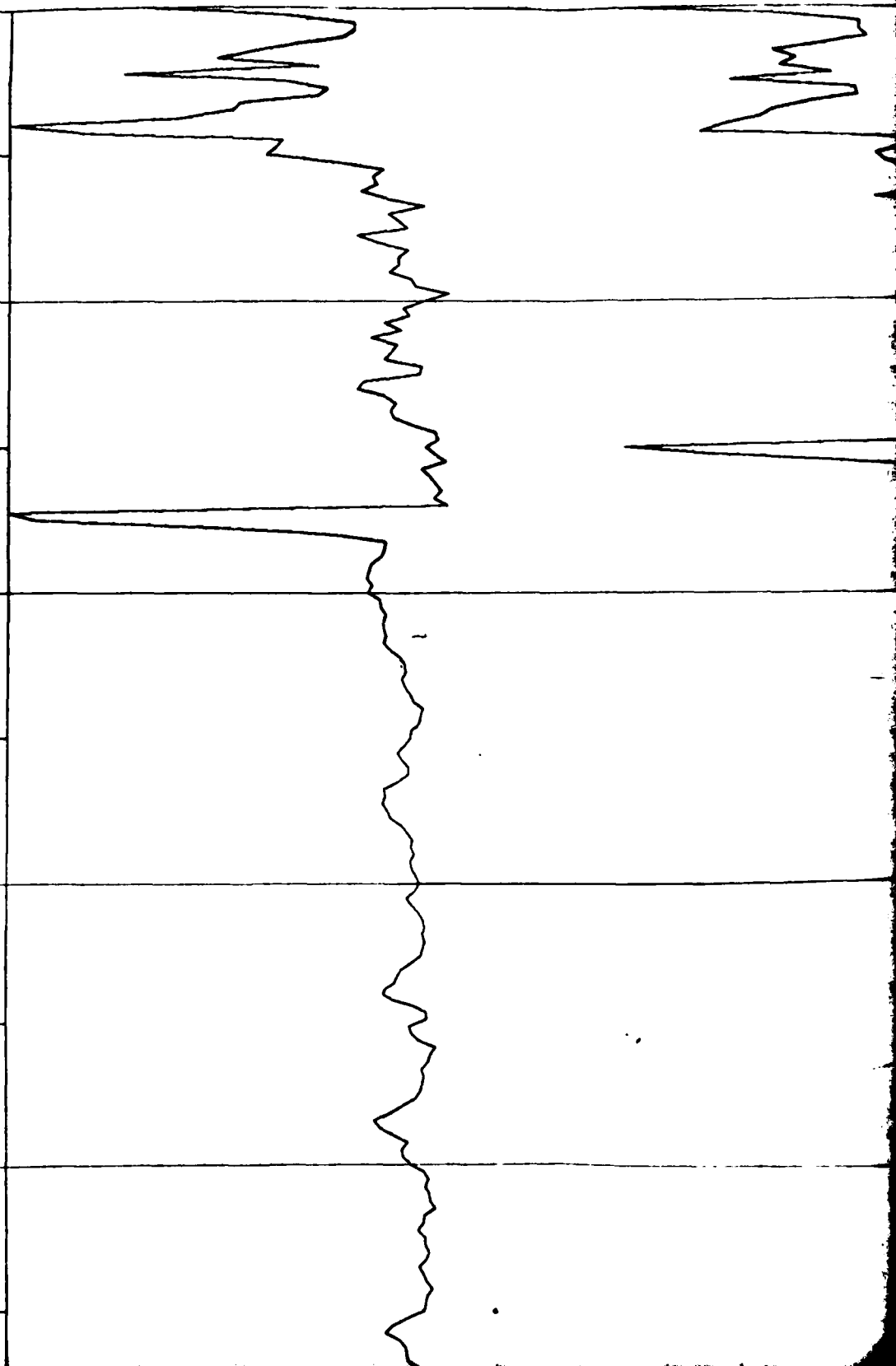
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- 54

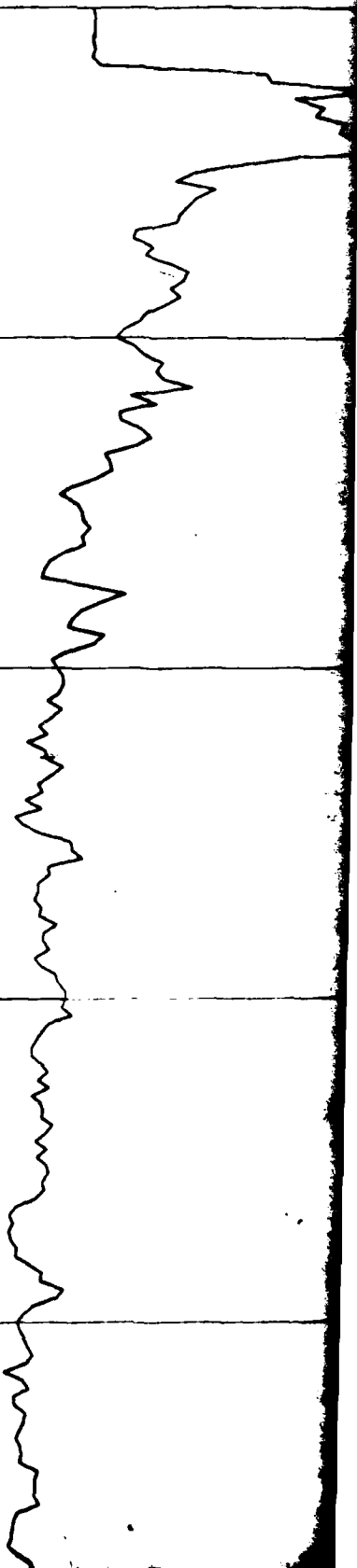
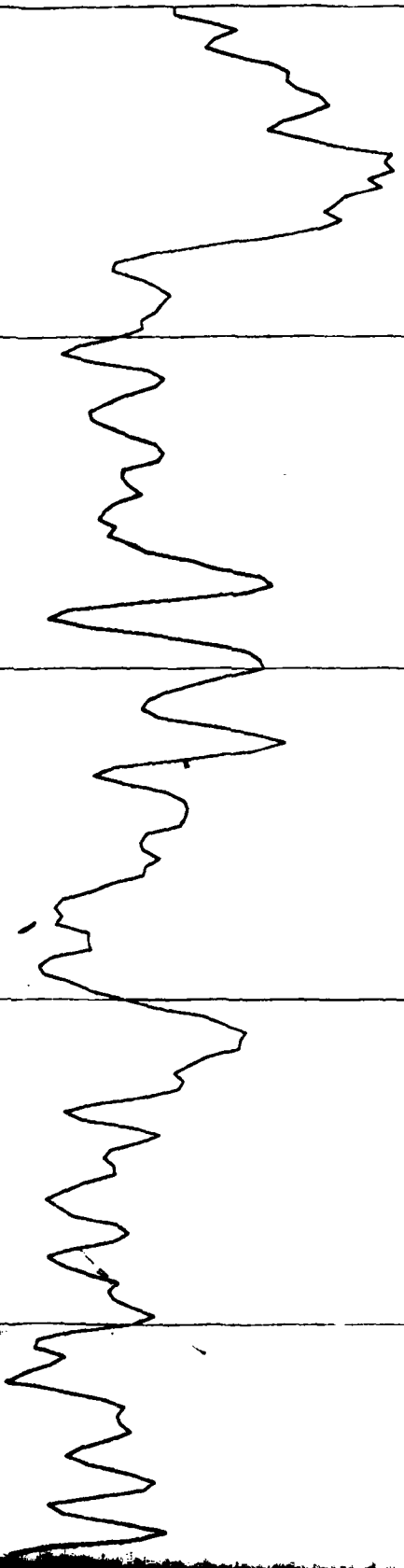
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48

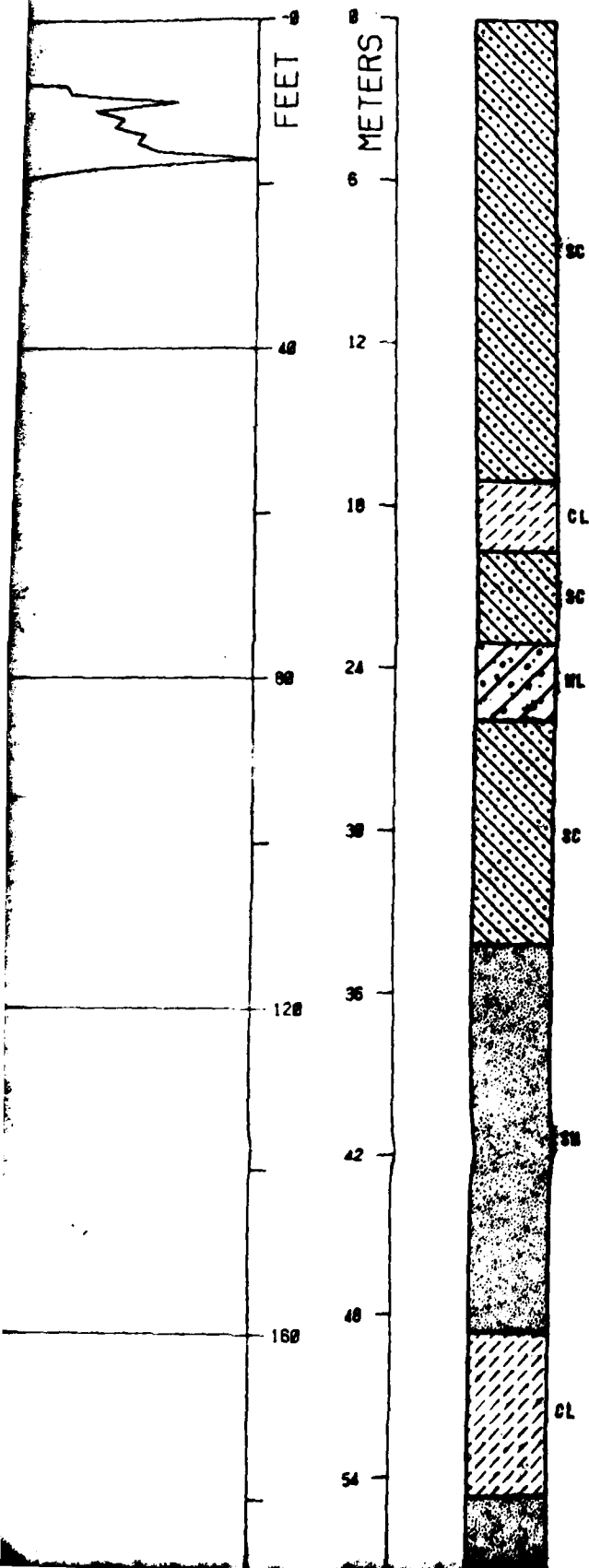
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WASHINGTON STATE UNIVERSITY

COLLEGE OF ENGINEERING

GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

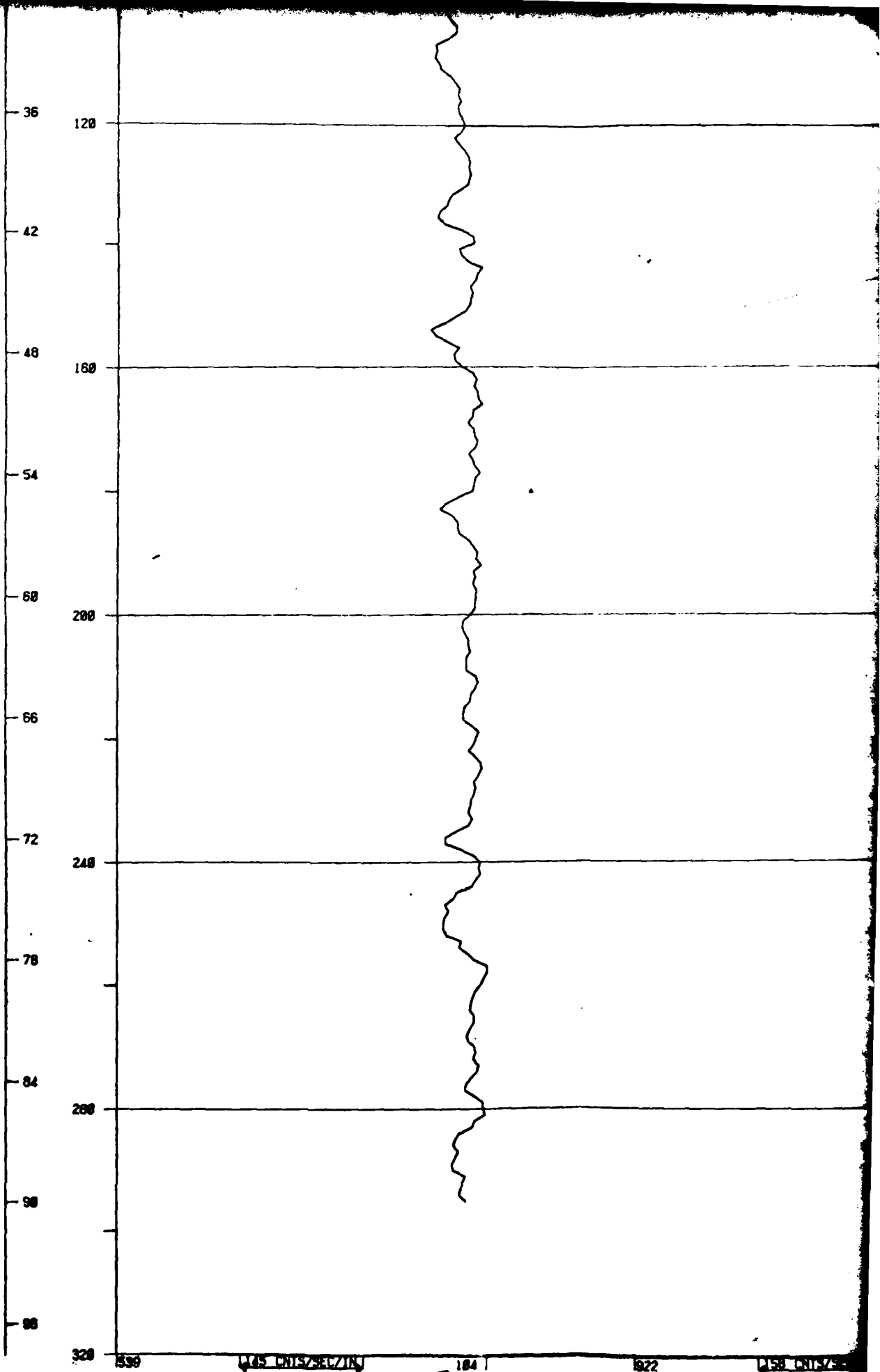
PROJECT NAME AIR FORCE
BORING NO. LD-C-4
ELEVATION 910' (277m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/8/77
TOTAL DEPTH LOGGED . . 297' (90m)
DEPTH TO WATER LEVEL . —
REMARKS —

EXPLANATION

LOG TITLES

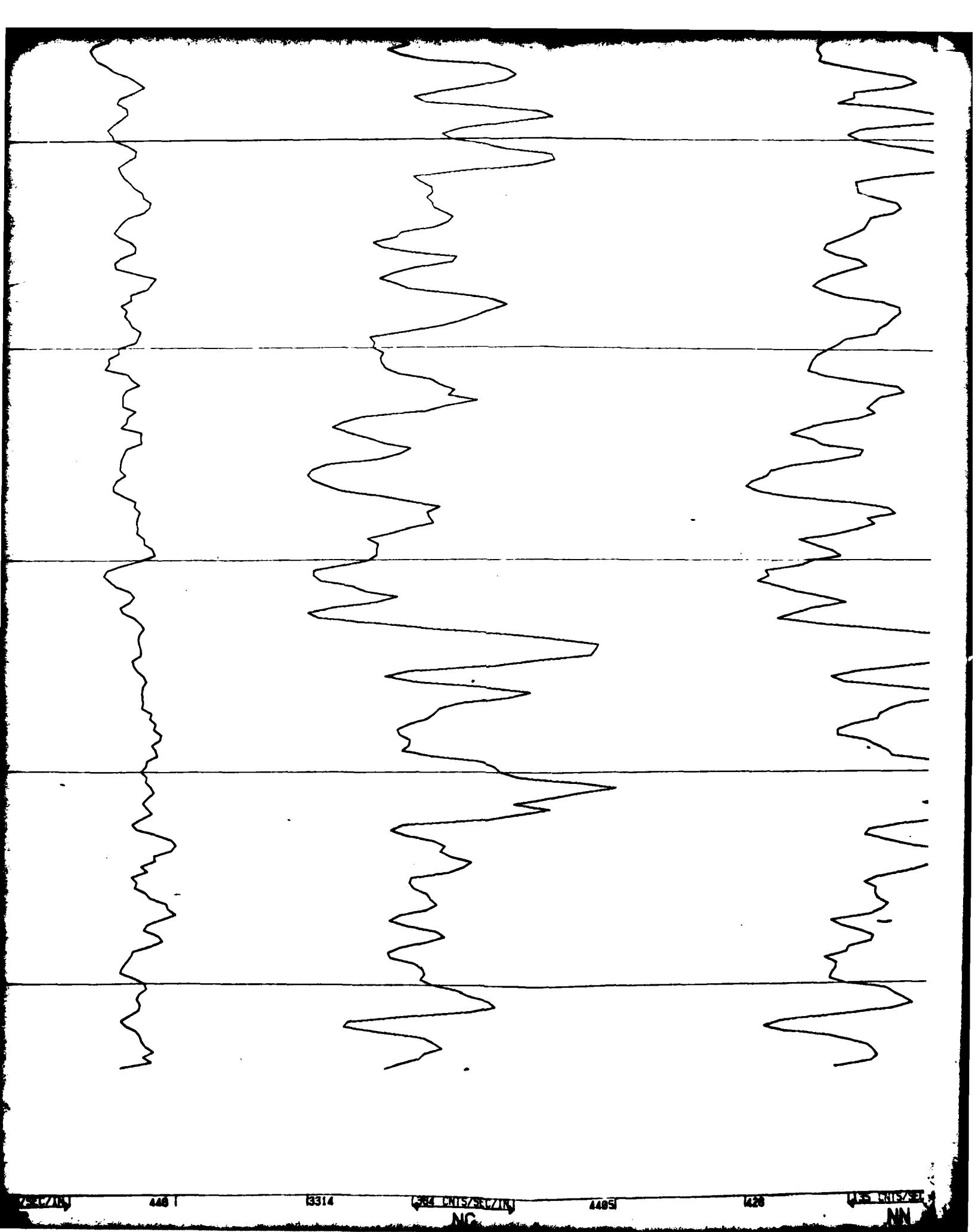
NATG - - - NATURAL GAMMA
GG - - - GAMMA GAMMA
NN - - - NEUTRON NEUTRON
NG - - - NEUTRON GAMMA
FT - - - FLUID TEMPERATURE
FR - - - FLUID RESISTIVITY
CALP - - - CALIPER
SP - - - SPONTANEOUS POTENTIAL
WRES - - - RESISTIVITY
FMTR - - - FLOW METER
GM - - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES ———→
POROSITY (NN-LOG) INCREASES ←——
WATER LEVEL



GM

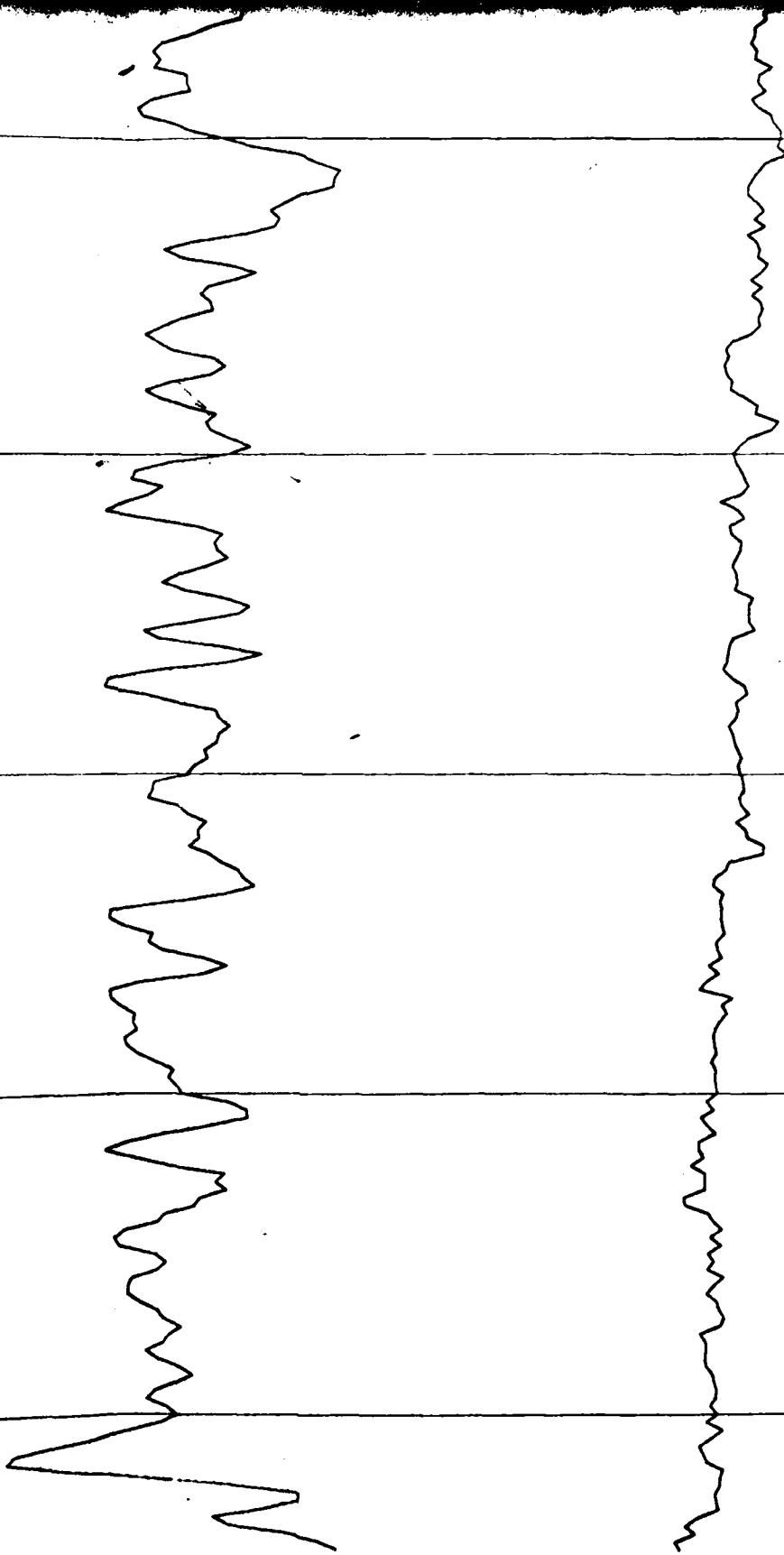
GG



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V V

V V



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EXPLANATION

LOG TITLES

NATG - - - NATURAL GAMMA
 GG - - - GAMMA GAMMA
 NN - - - NEUTRON NEUTRON
 NG - - - NEUTRON GAMMA
 FT - - - FLUID TEMPERATURE
 FR - - - FLUID RESISTIVITY
 CALP - - - CALIPER
 SP - - - SPONTANEOUS POTENTIAL
 WRES - - - RESISTIVITY
 FMTR - - - FLOW METER
 GM - - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
 POROSITY (NN-LOG) INCREASES ←
 WATER LEVEL - - - -

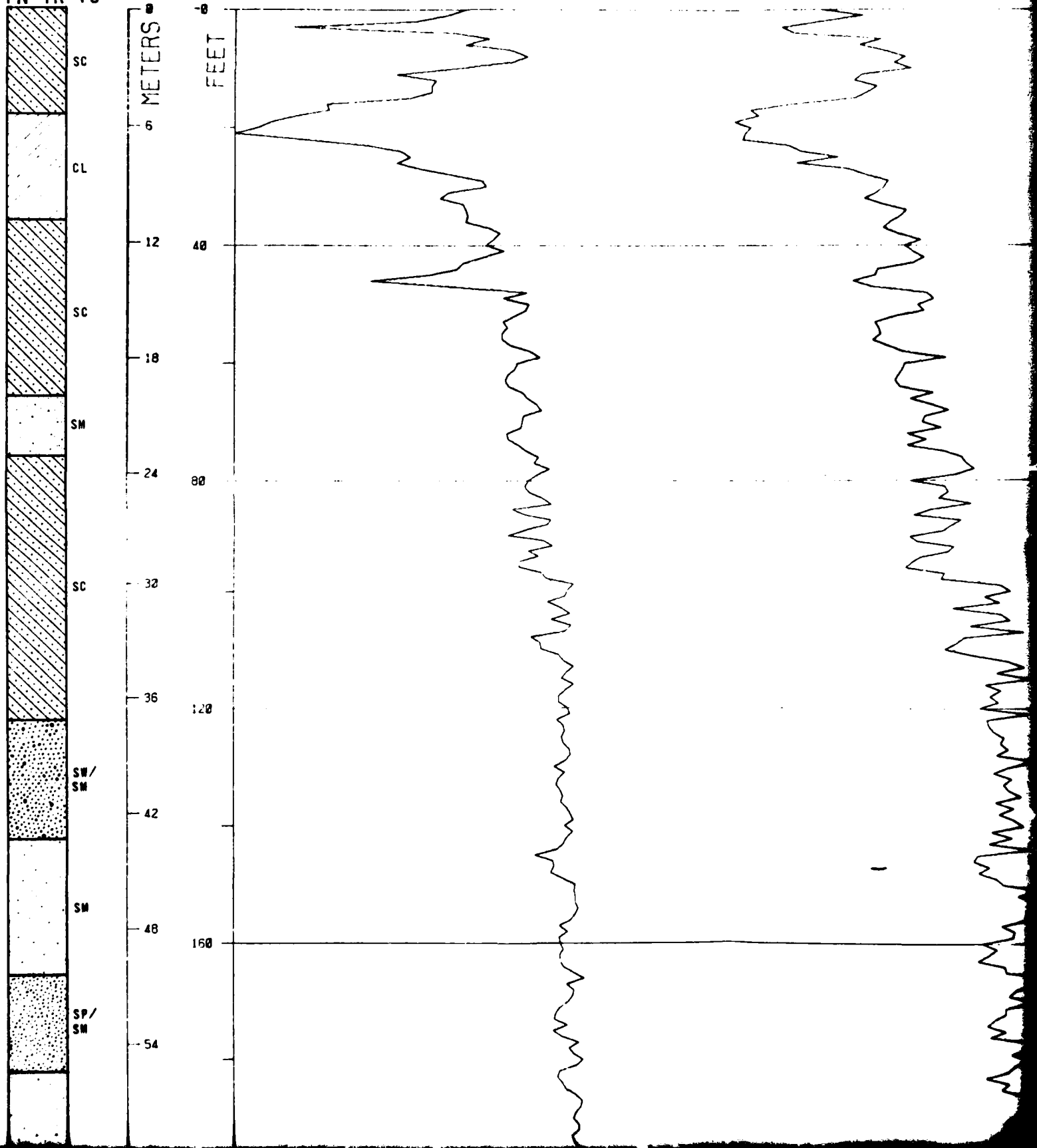
NUCLEAR GEOPHYSICAL LOGS
 SPRING LB-0-4
 LEGUENILLA DESERT, ARIZONA

MX SITING INVESTIGATION
 DEPARTMENT OF THE AIR FORCE - SANDO

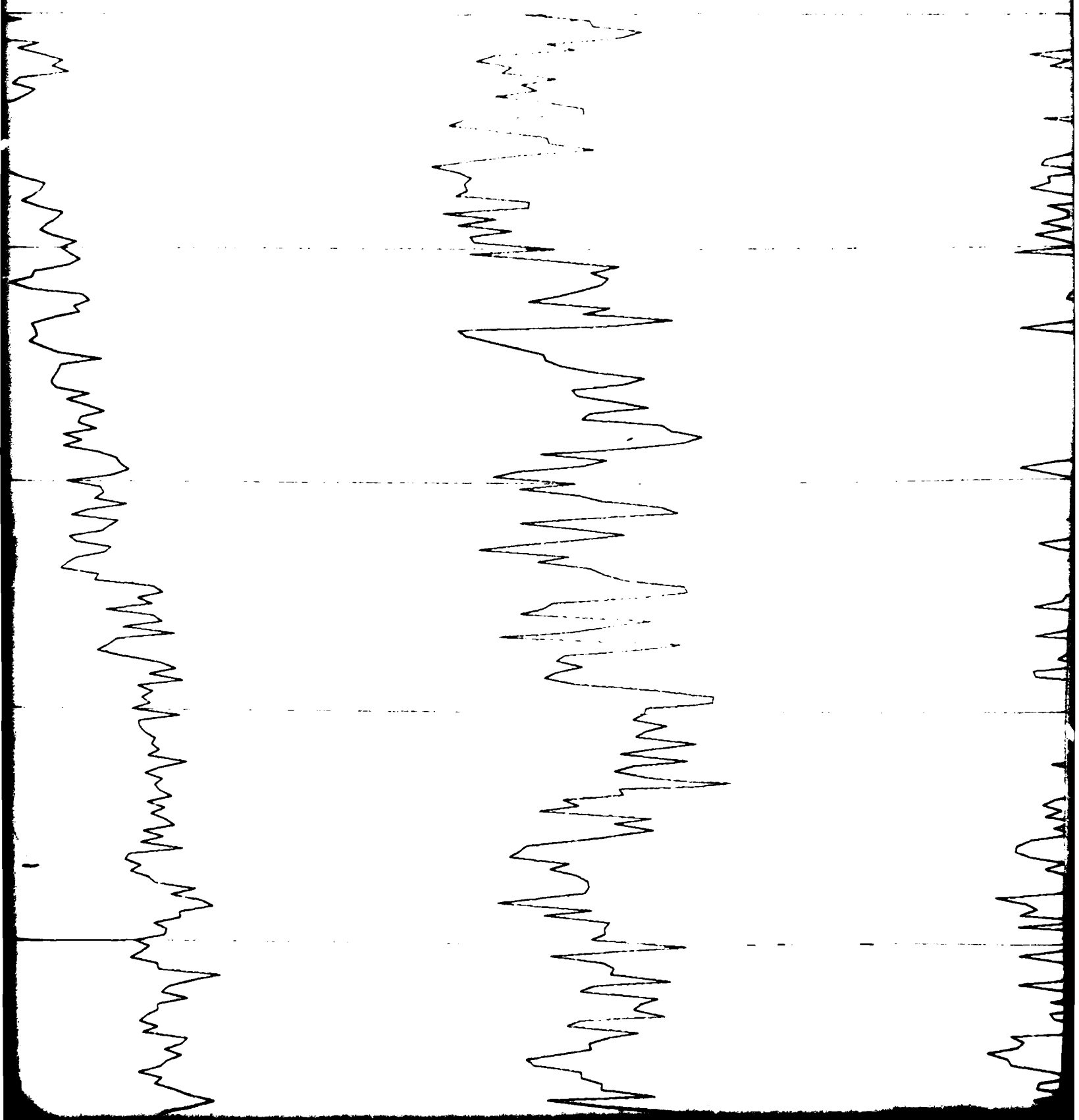
JUNE 1964
 A-7

FURBER NATIONAL LAB.

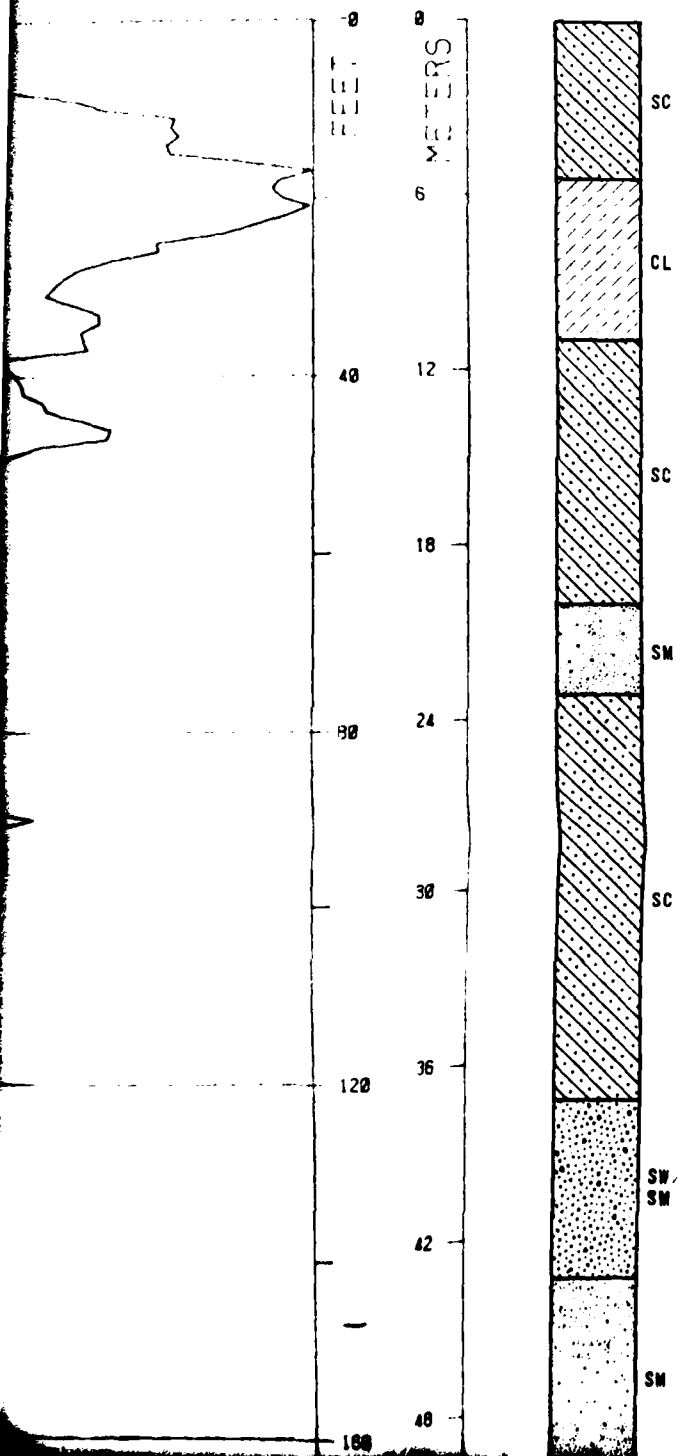
FN-TR-19



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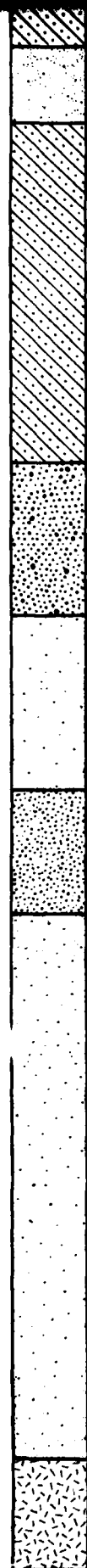
WASHINGTON STATE UNIVERSITY COLLEGE OF ENGINEERING

GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
BORING NO. LD-C-5
ELEVATION 880' (268m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/11/77
TOTAL DEPTH LOGGED . . 263' (80m)
DEPTH TO WATER LEVEL . 248' (76m)
REMARKS

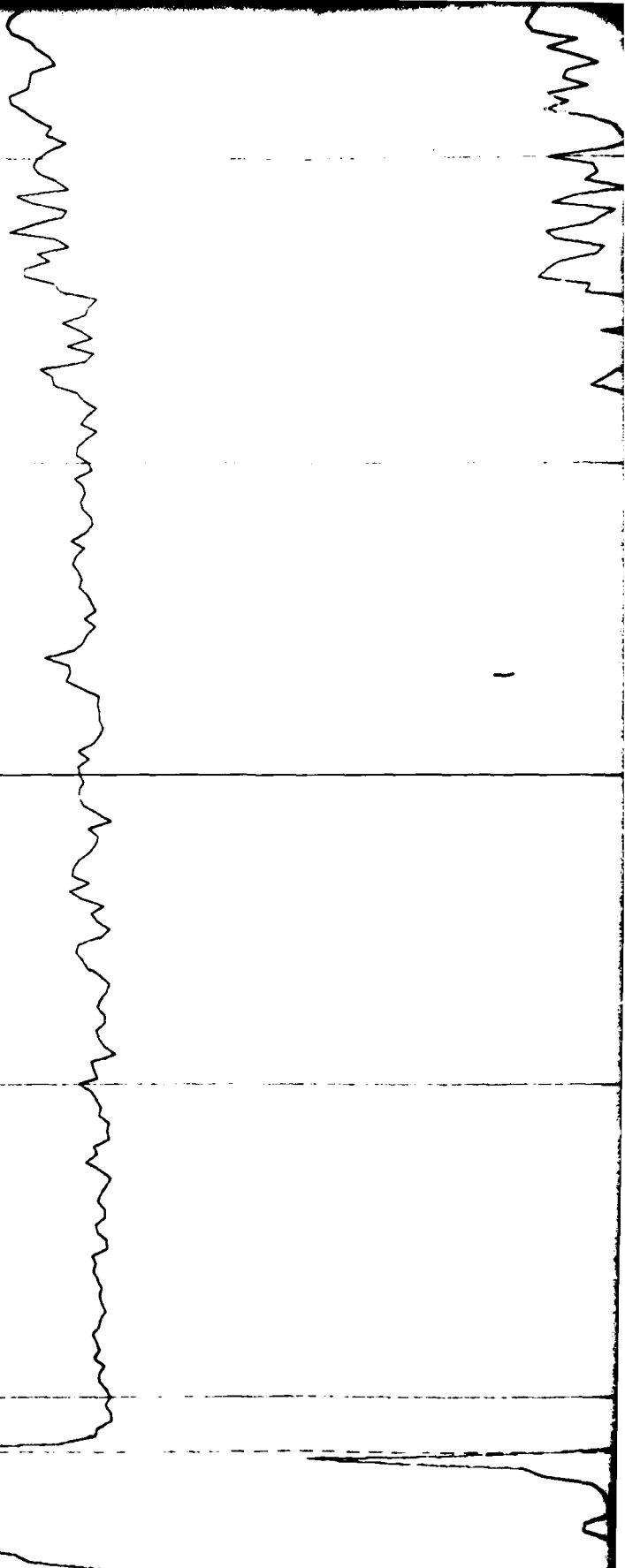
LOG TITLES
NATG - - NATURAL GAMMA
CG - - GAMMA
NN - - NEUTRON NEUTRON
NG - - NEUTRON GAMMA
FT - - FLUID TEMPERATURE
FR - - FLUID RESISTIVITY
CALP - - CALIPER
SP - - SPONTANEOUS POTENTIAL
WRES - - RESISTIVITY
FMTR - - FLOW METER
GM - - DELTA GAMMA

EXPLANATION



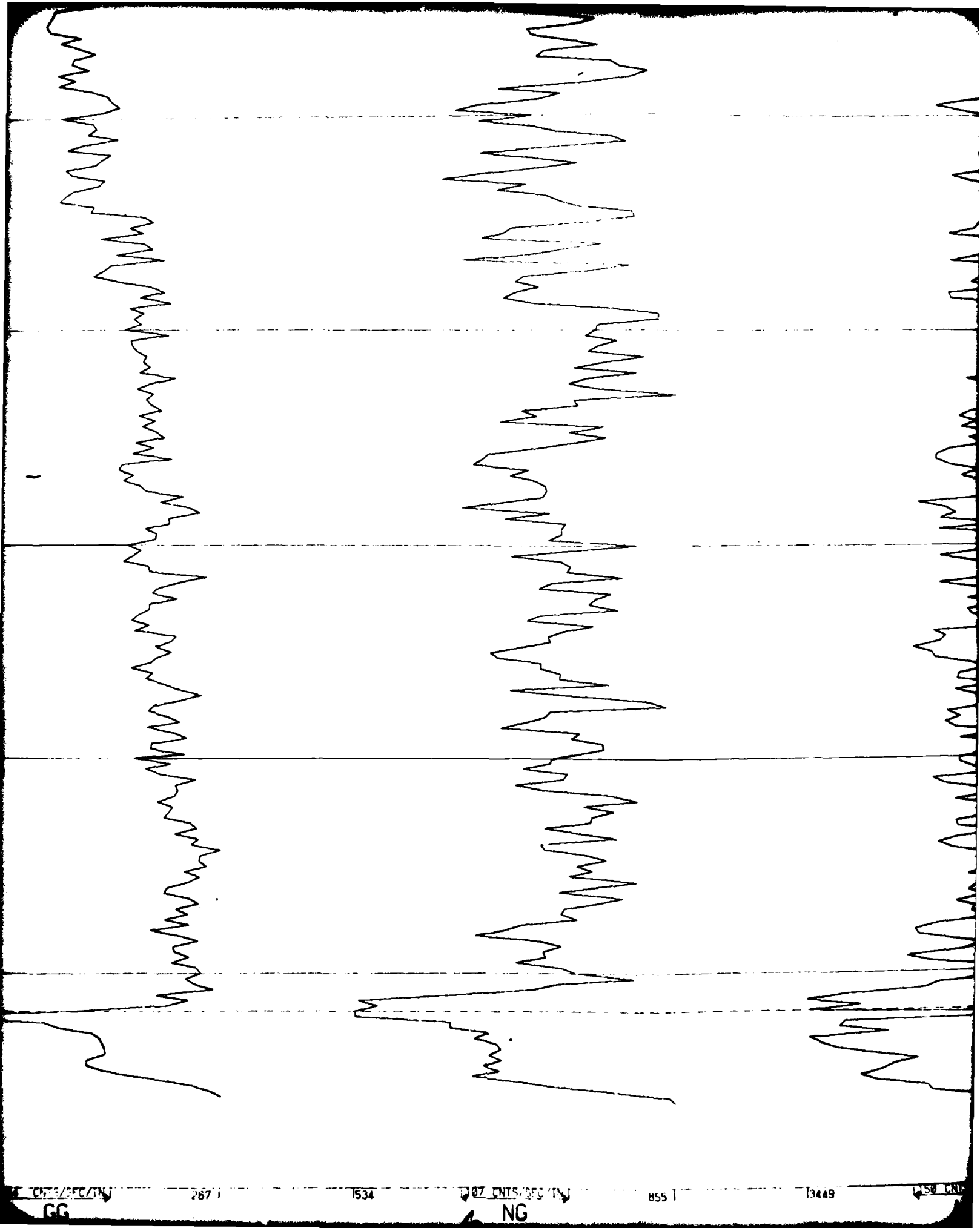
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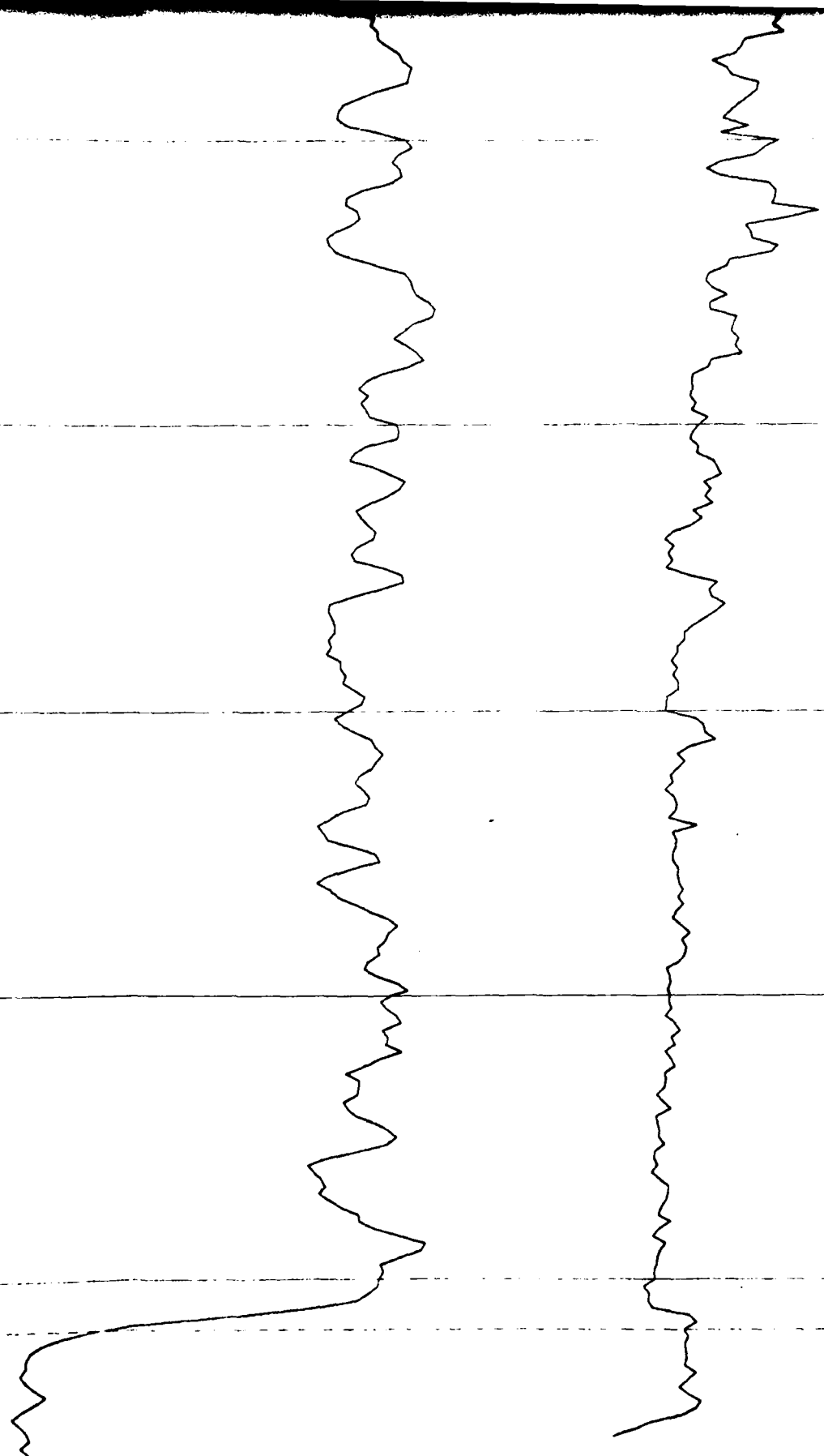


142 130 CNTS/SEC/IN 1550 184 CNTS/SEC/IN

GM 5 GG



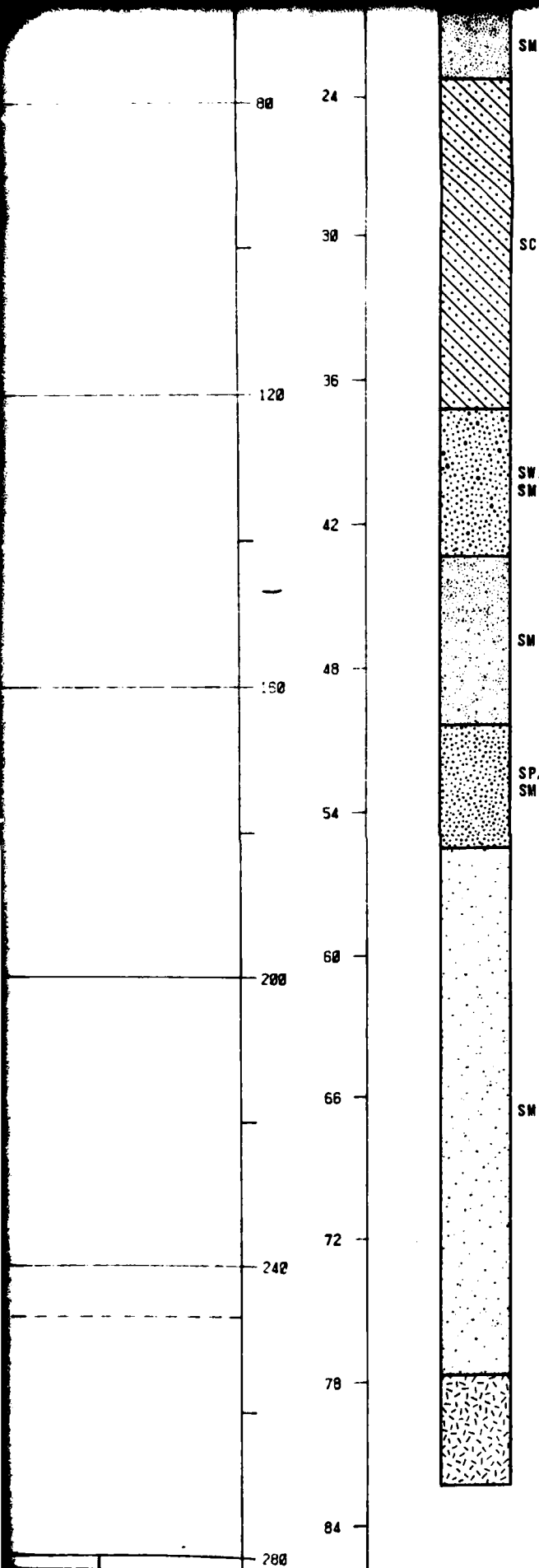
Handwritten text, possibly a list or notes, oriented vertically on the left side of the page.



STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/11/77
TOTAL DEPTH LOGGED 263' (80m)
DEPTH TO WATER LEVEL 248' (76m)
REMARKS —

EXPLANATION
LOG TITLES
NATG - - - NATURAL GAMMA
GG - - - GAMMA GAMMA
NN - - - NEUTRON NEUTRON
NG - - - NEUTRON GAMMA
FT - - - FLUID TEMPERATURE
FR - - - FLUID RESISTIVITY
CALP - - - CALIPER
SP - - - SPONTANEOUS POTENTIAL
WRES - - - RESISTIVITY
FMTR - - - FOOT METER
GM - - - DELTA GAMMA

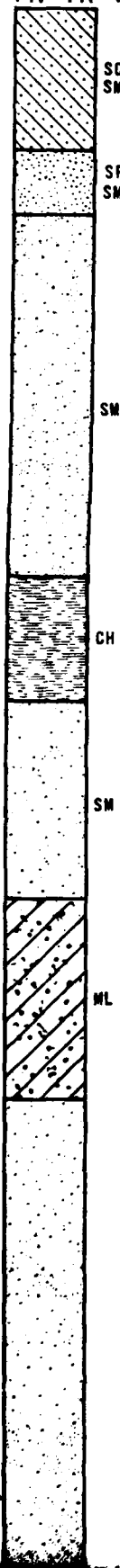
DENSITY (GG-LOG) INCREASES →
POROSITY (NN-LOG) INCREASES ←
WATER LEVEL -----



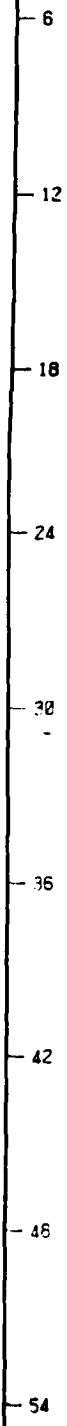
NUCLEAR GEOPHYSICAL LOGS BORING LD-C-5 LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SAMSO	DRAWING A-8
FURRO NATIONAL INC.	

8

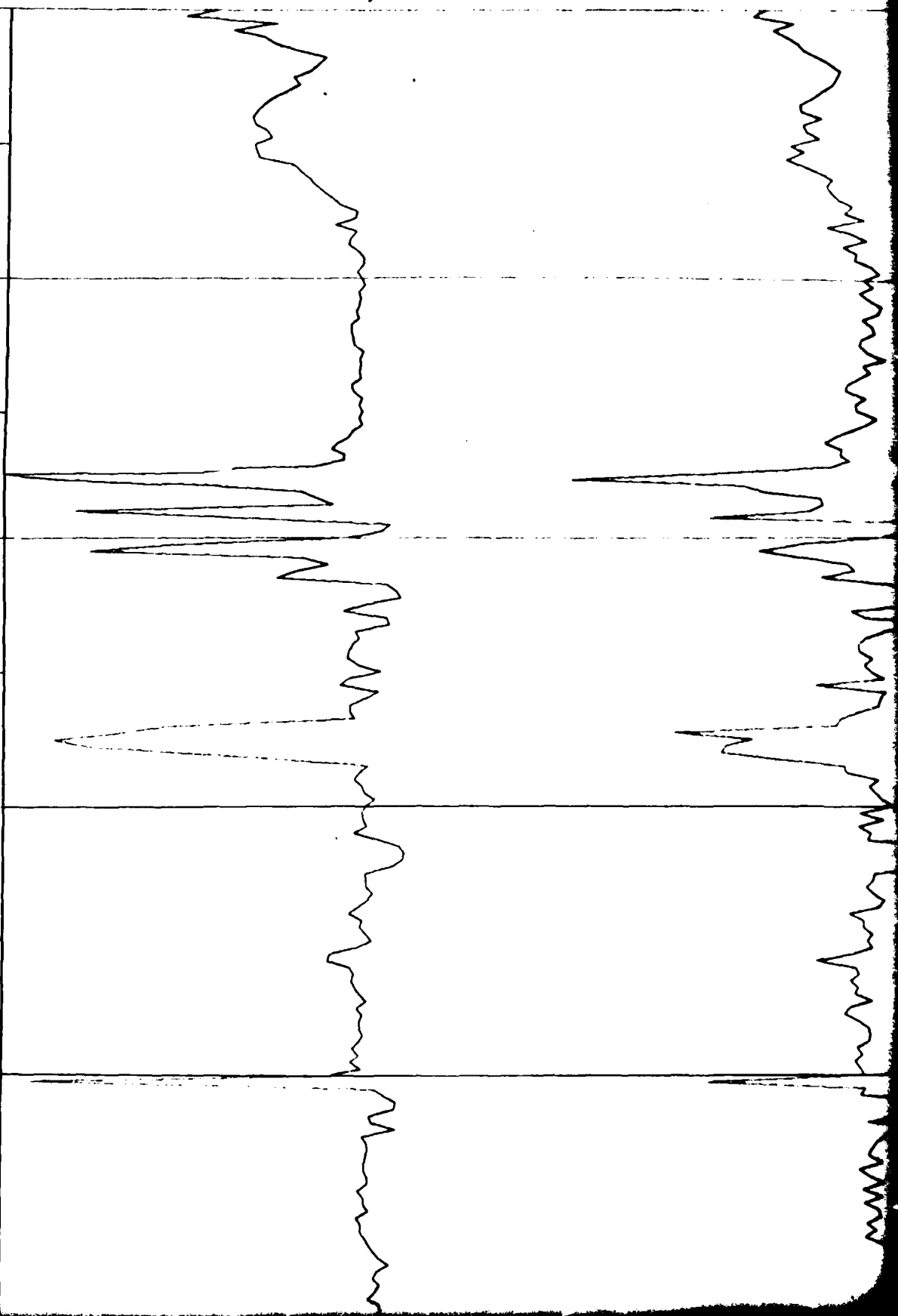
FN-TR-19

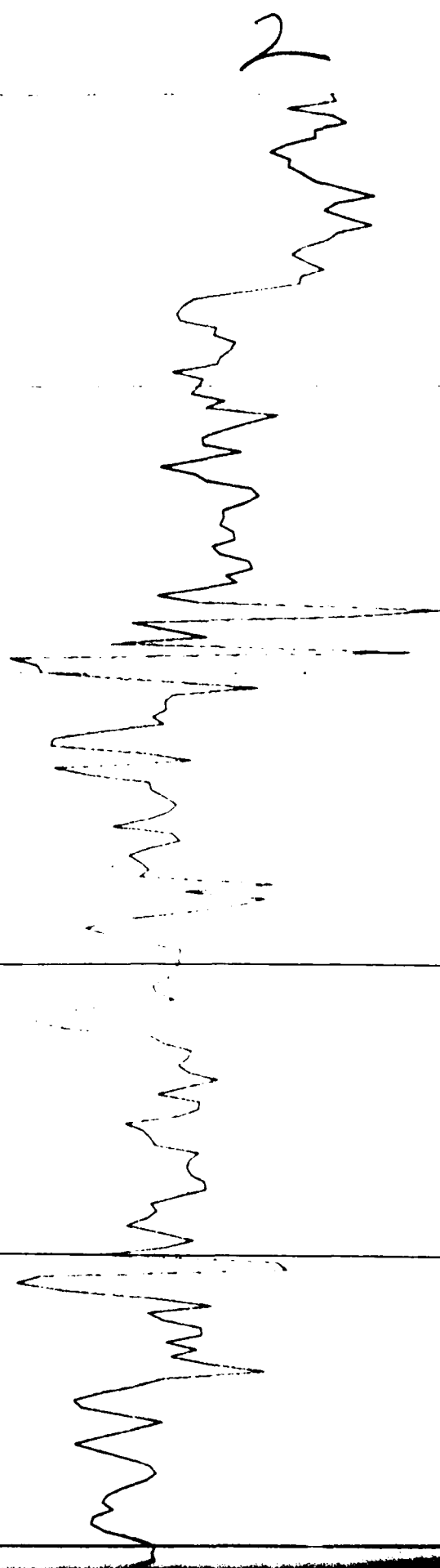
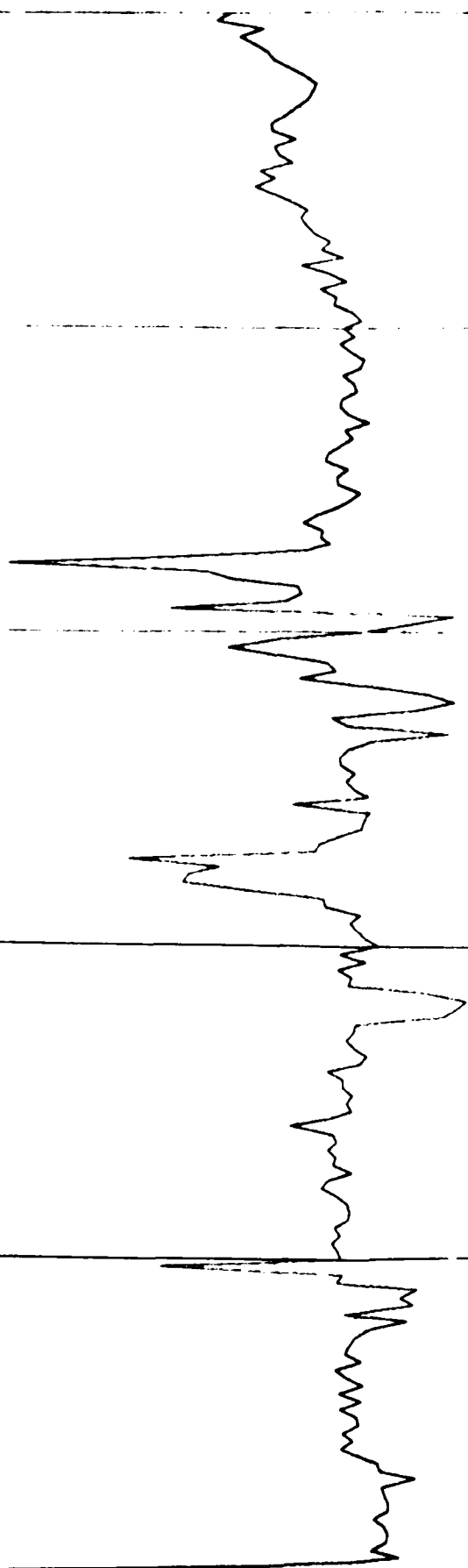


METERS

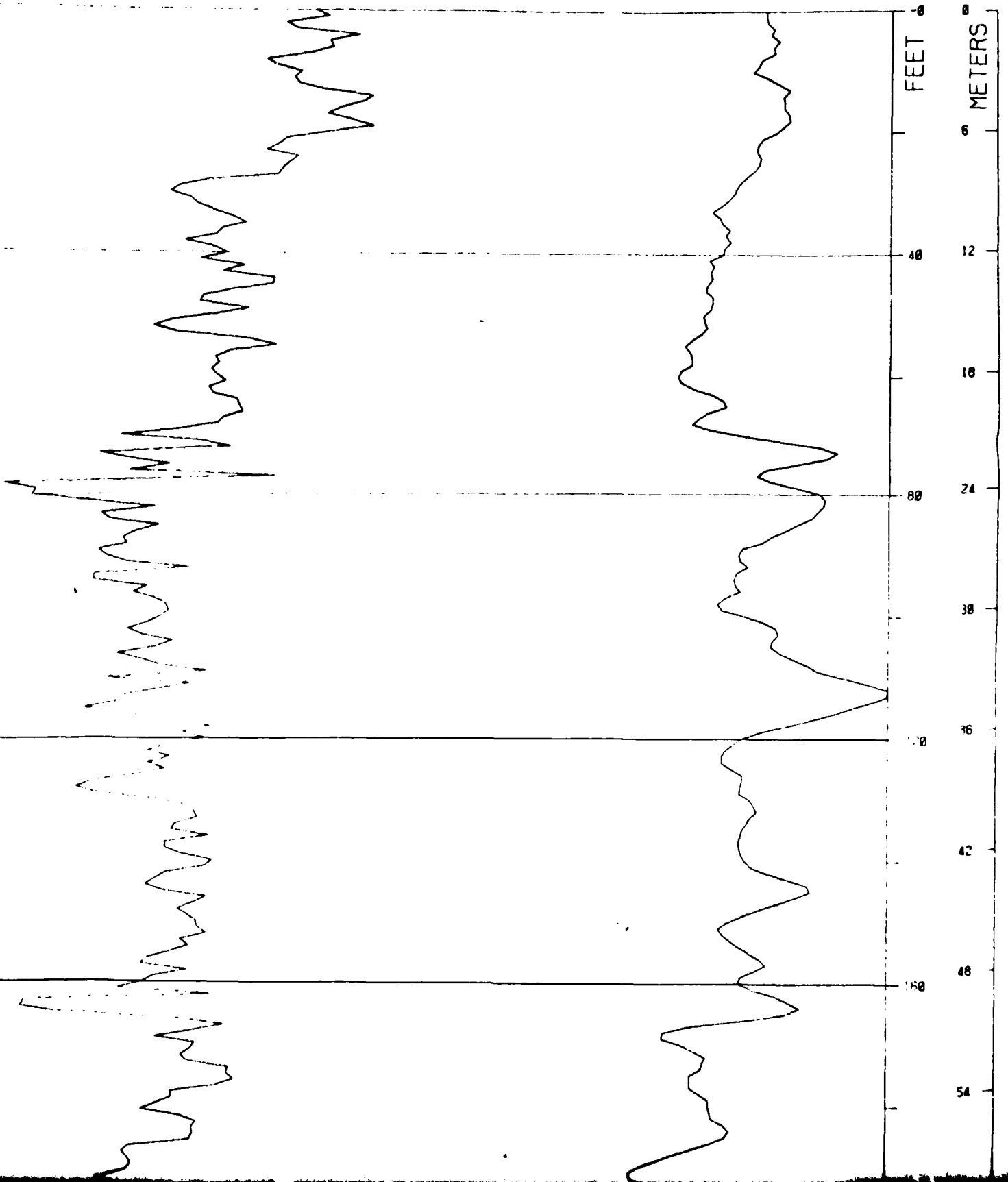


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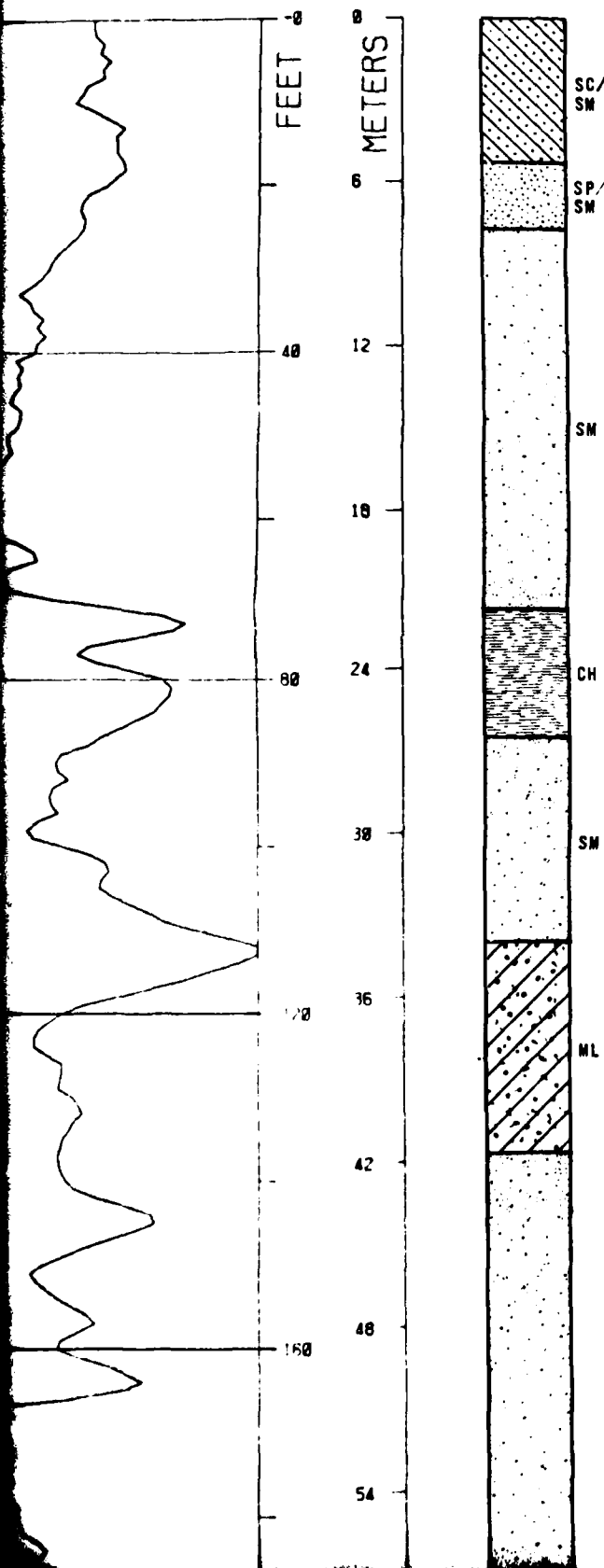




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WASHINGTON STATE UNIVERSITY COLLEGE OF ENGINEERING

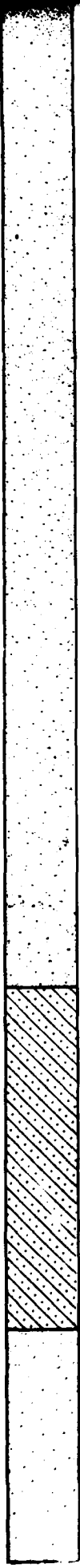
GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
BORING NO. LD-C-6
ELEVATION 560' (171m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/24/77
TOTAL DEPTH LOGGED . . 383' (117m)
DEPTH TO WATER LEVEL . —
REMARKS —

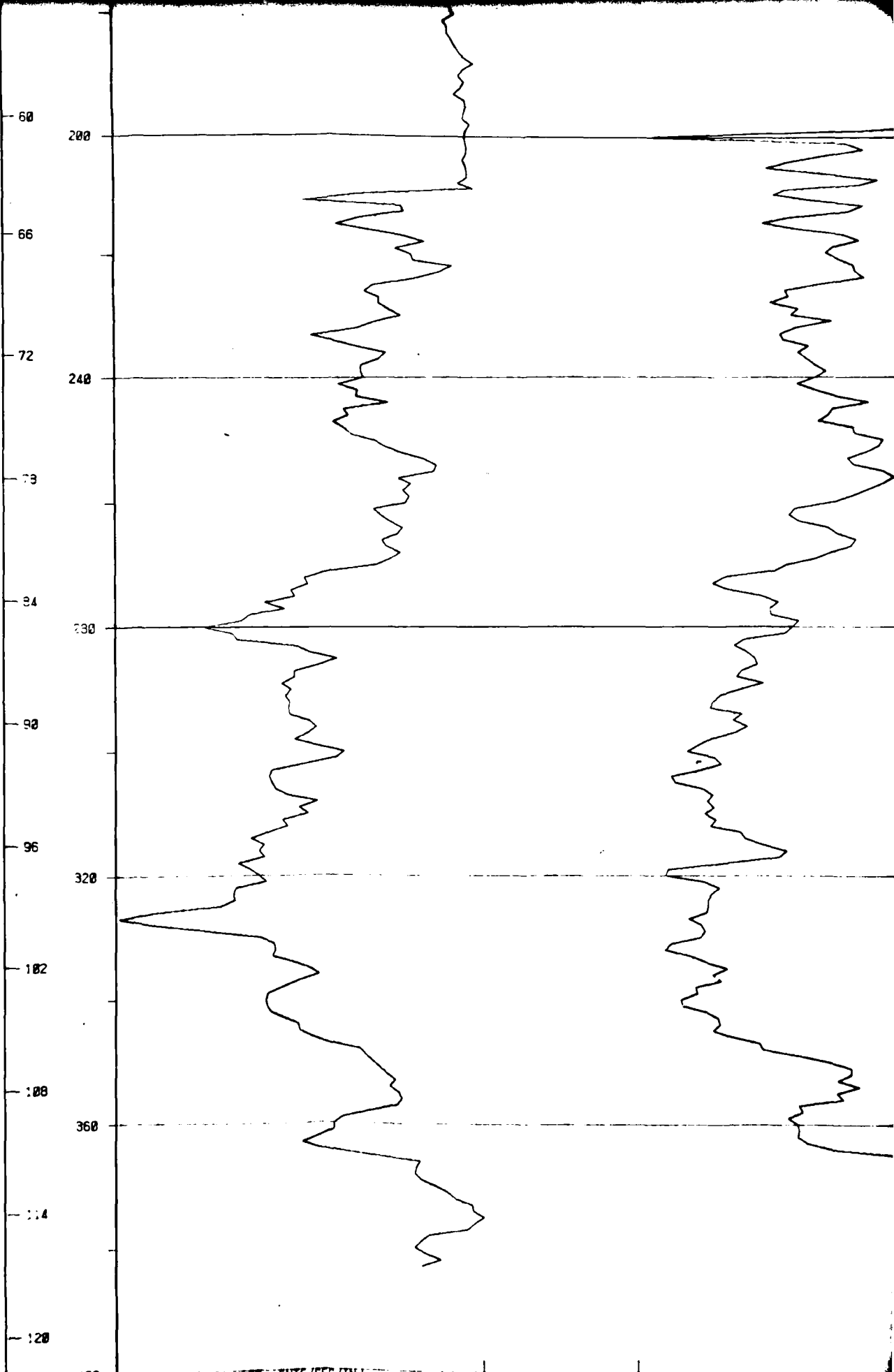
EXPLANATION

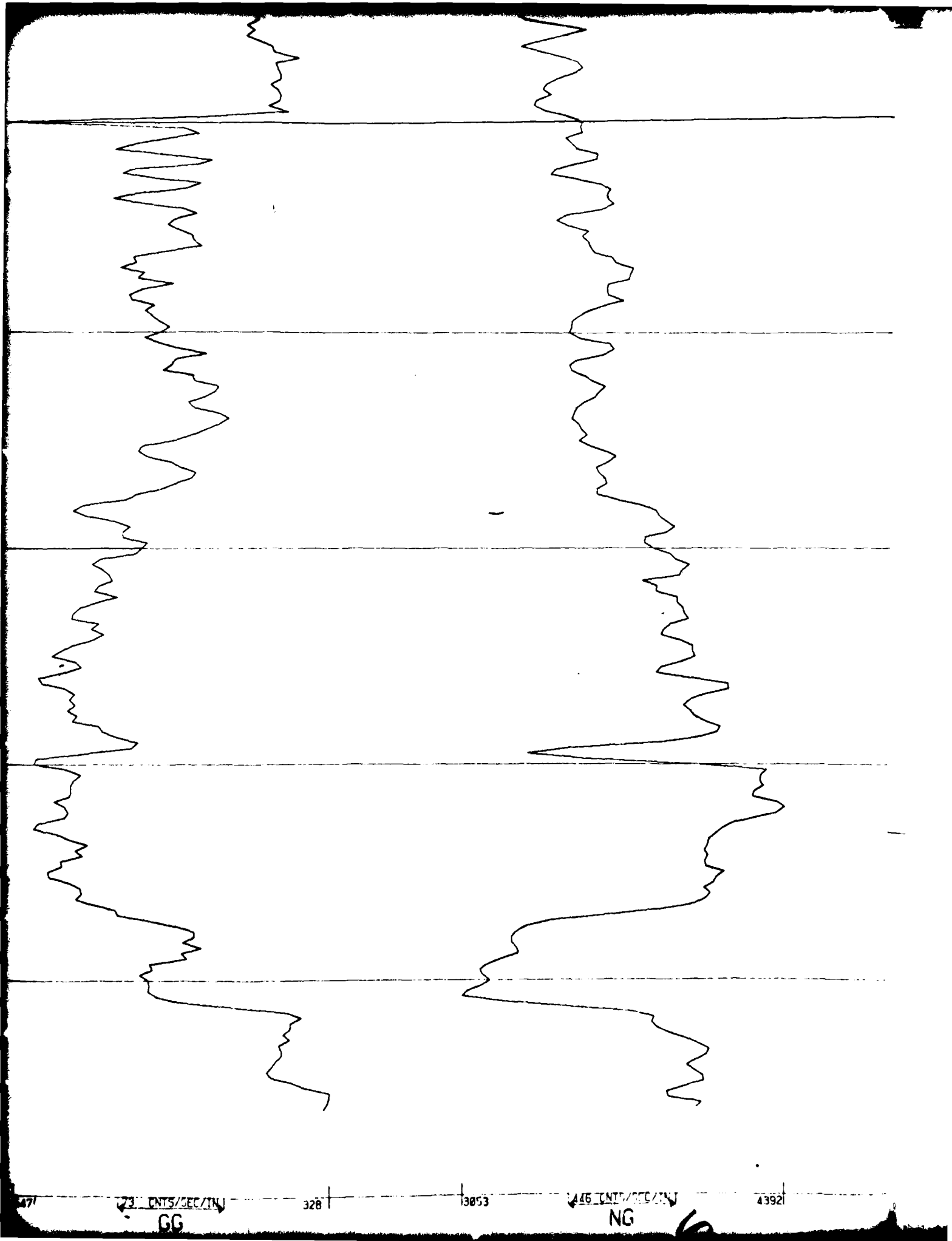
LOG TITLES
NATG — NAT. RES. GAMMA
GAM — GAMMA
NIN — NEUTRON NEUTRON
NG — NEUTRON GAMMA
T — TEMPERATURE
RA — RESISTIVITY
CALP — CALIPER
OP — OPENNESS POTENTIAL
WRES — RESISTIVITY
FMTR — FLOW METER
DTG — DELTA GAMMA

DENSITY LOG LOG INCREASES ———→
DENSITY LOG LOG INCREASES ←——
WATER LEVEL ———



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FUBRO NATIONAL INC LONG BEACH CA

F/G 8/7

MX SITING INVESTIGATION. GEOTECHNICAL EVALUATION OF LUKE BOMBIN-ETC(U)

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4 of 4

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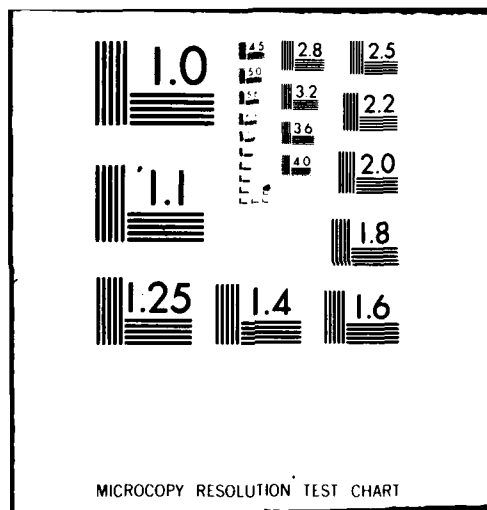
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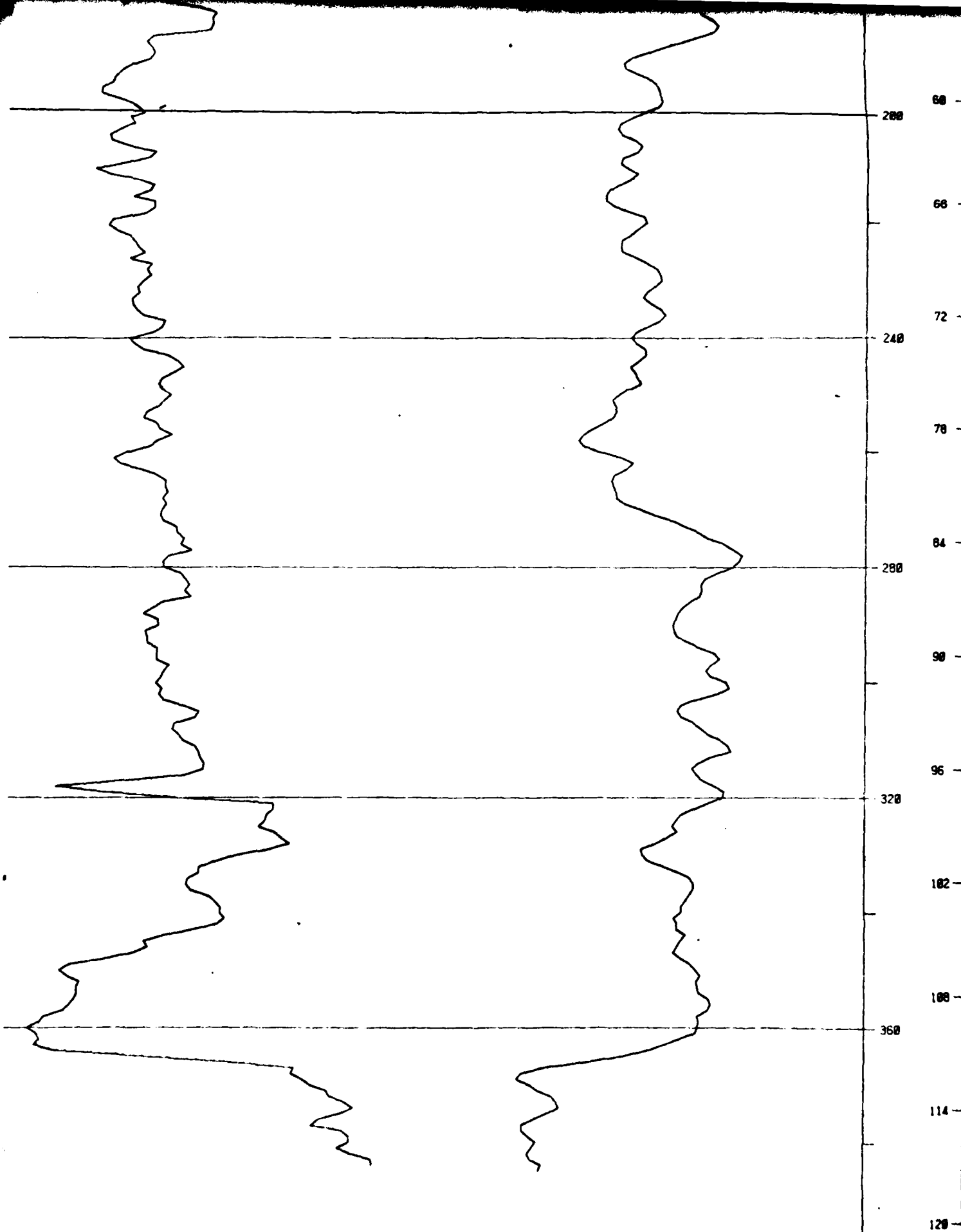
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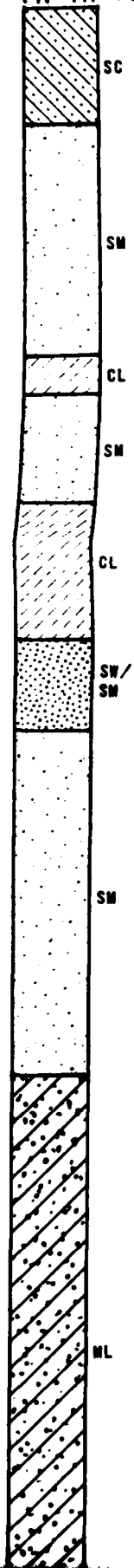
SM

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NUCLEAR GEOPHYSICAL LOGS BORING LD-C-6 LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANSO	DRAWING A-9
FUGRO NATIONAL INC.	

FN-TR-19

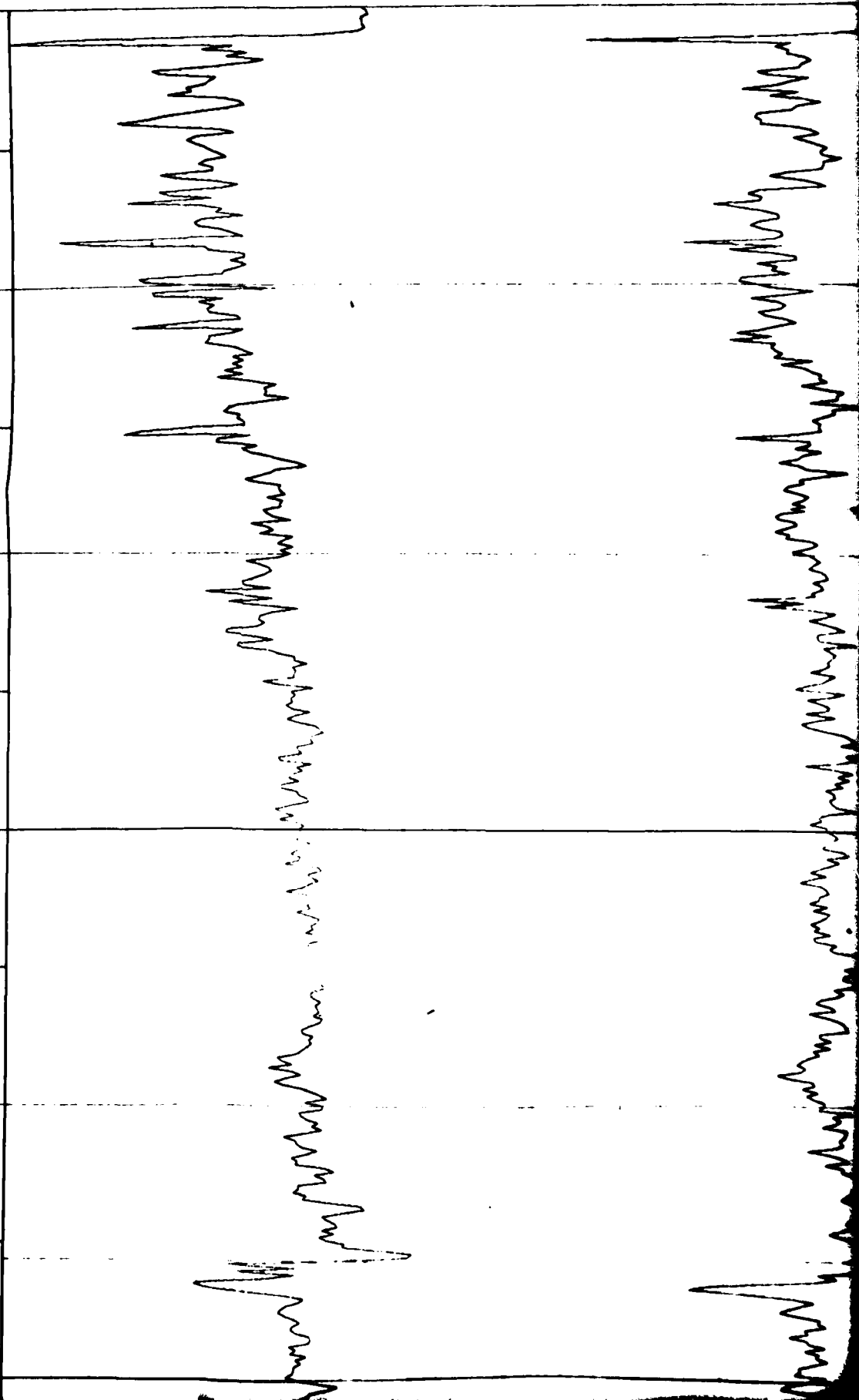


METERS

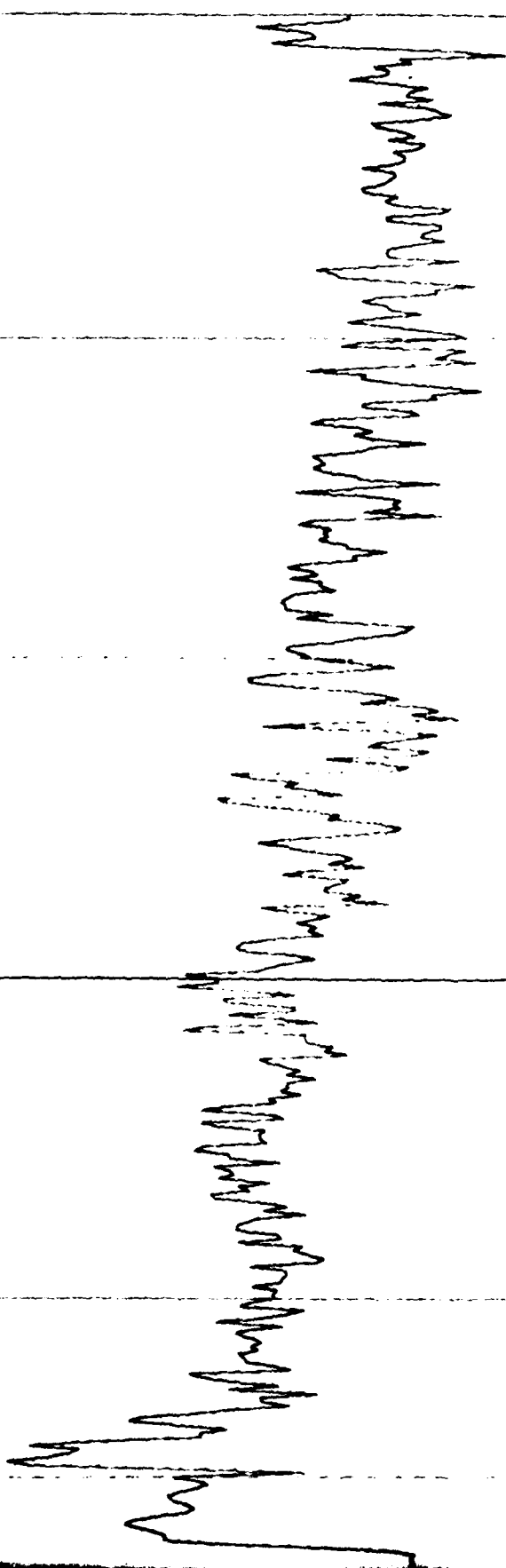
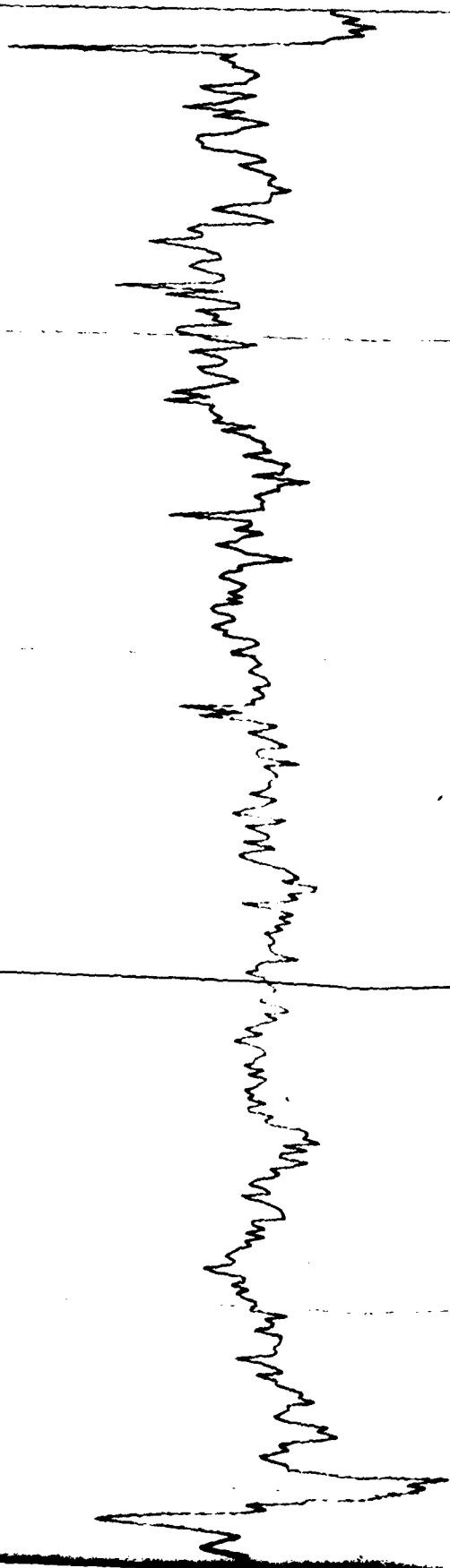
FEET

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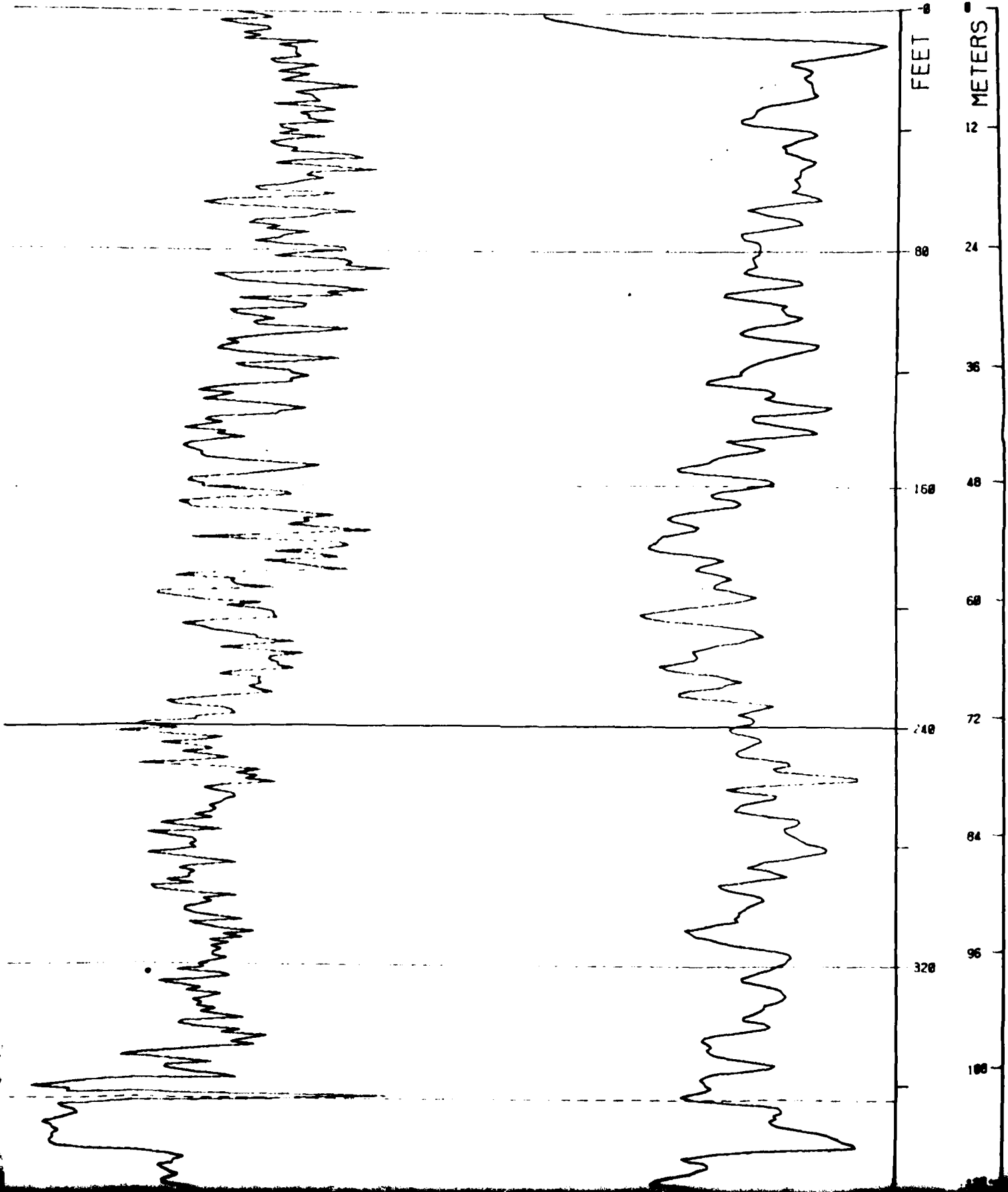
80
160
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400



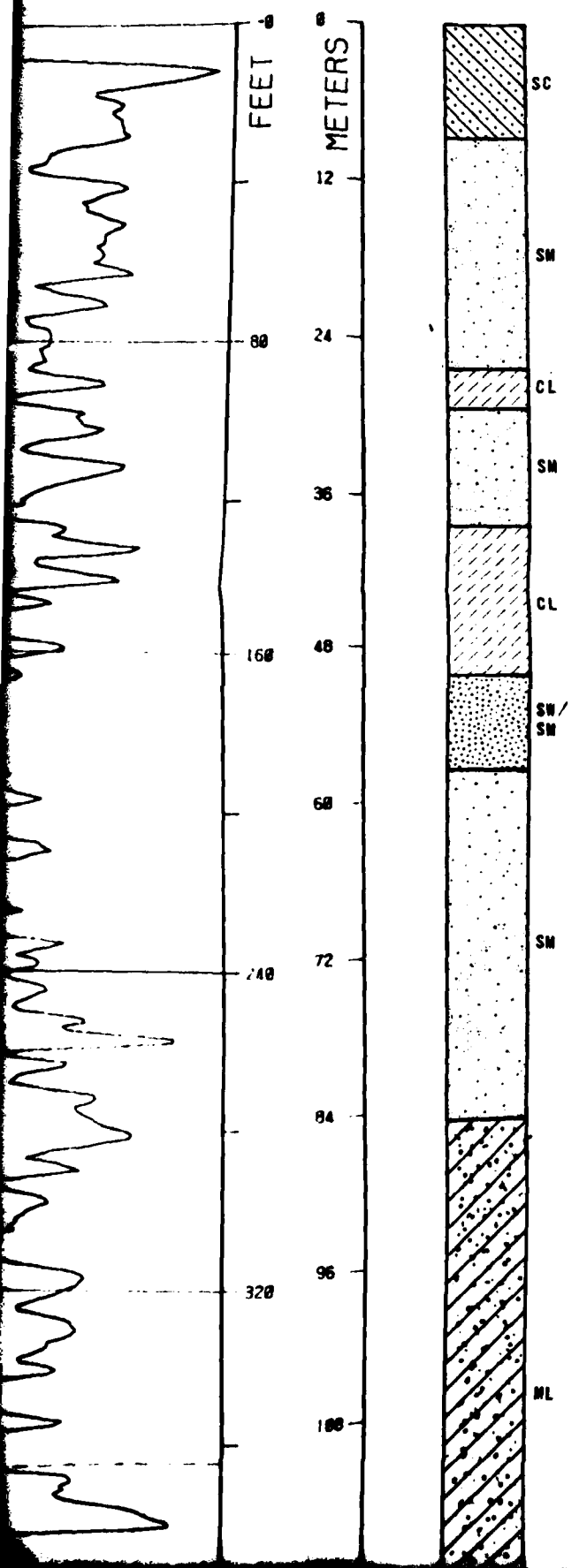
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WASHINGTON STATE UNIVERSITY

COLLEGE OF ENGINEERING

GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

PROJECT NAME AIR FORCE
BORING NO. LD-0-1
ELEVATION 780' (238m)
STATE ARIZONA
COUNTY YUMA
STUDY AREA LECHUGUILLA DES.
DATE LOGGED 5/05/77
TOTAL DEPTH LOGGED . . 731' (223m)
DEPTH TO WATER LEVEL . 366' (112m)
REMARKS

EXPLANATION

LOG TITLES

NATG - - NATURAL GAMMA
GG - - GAMMA GAMMA
NN - - NEUTRON NEUTRON
NG - - NEUTRON GAMMA
FT - - FLUID TEMPERATURE
FR - - FLUID RESISTIVITY
CALP - - CALIPER
SP - - SPONTANEOUS POTENTIAL
WRES - - RESISTIVITY
FMTR - - FLOW METER
GM - - DELTA GAMMA

DENSITY (GG-LOG) INCREASES →
POROSITY (NN-LOG) INCREASES ←
WATER LEVEL - - - -



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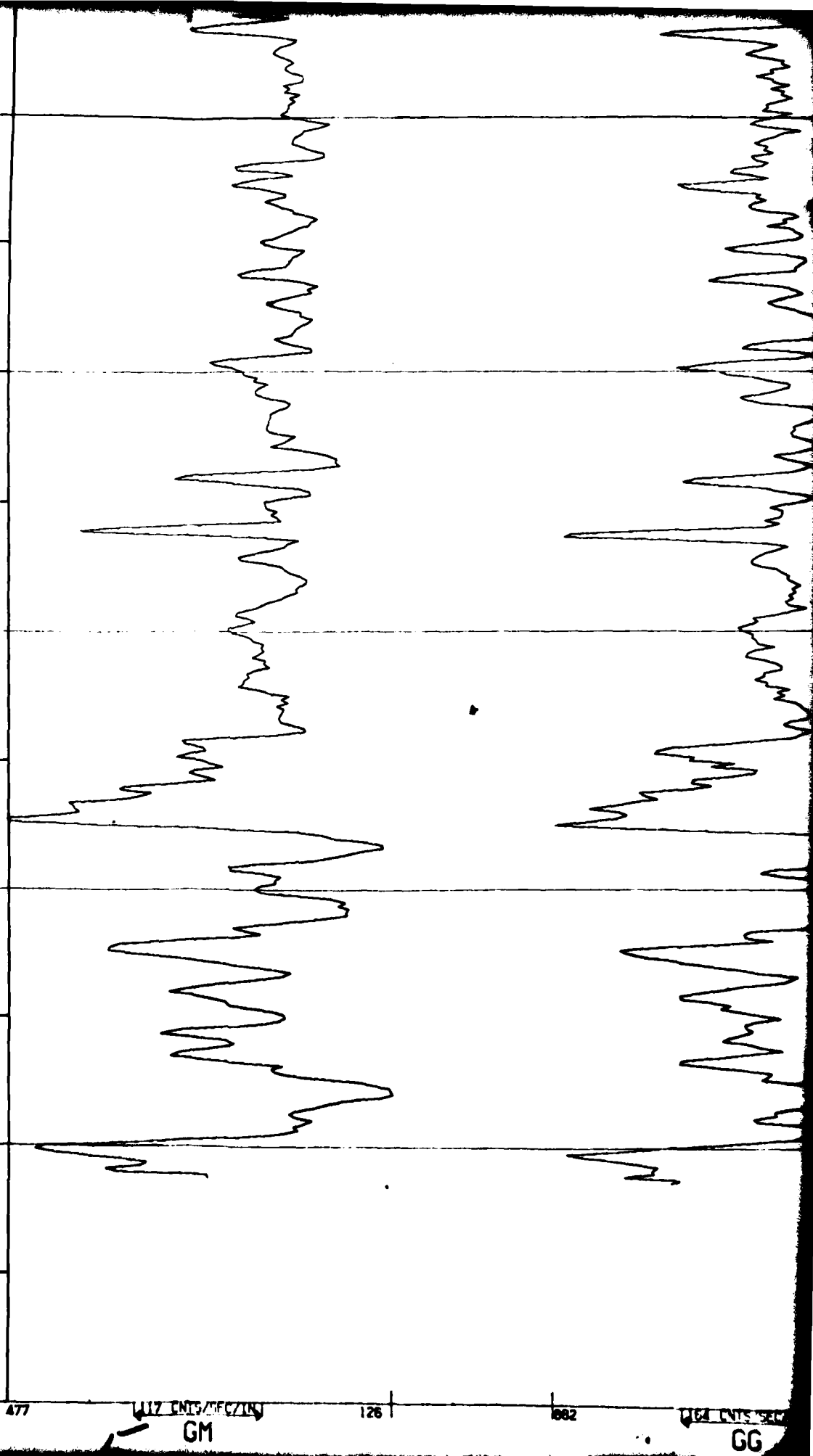
482

552

648

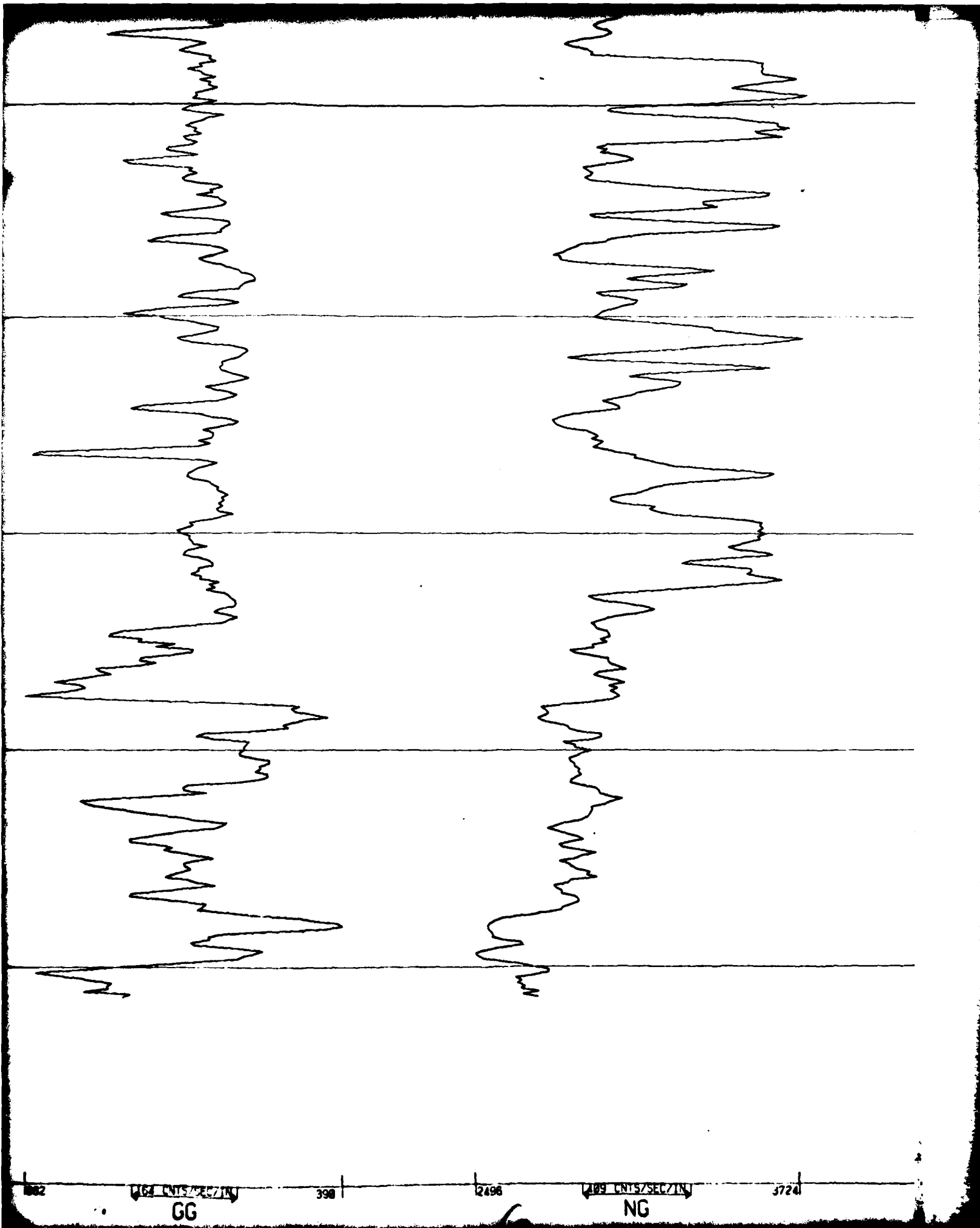
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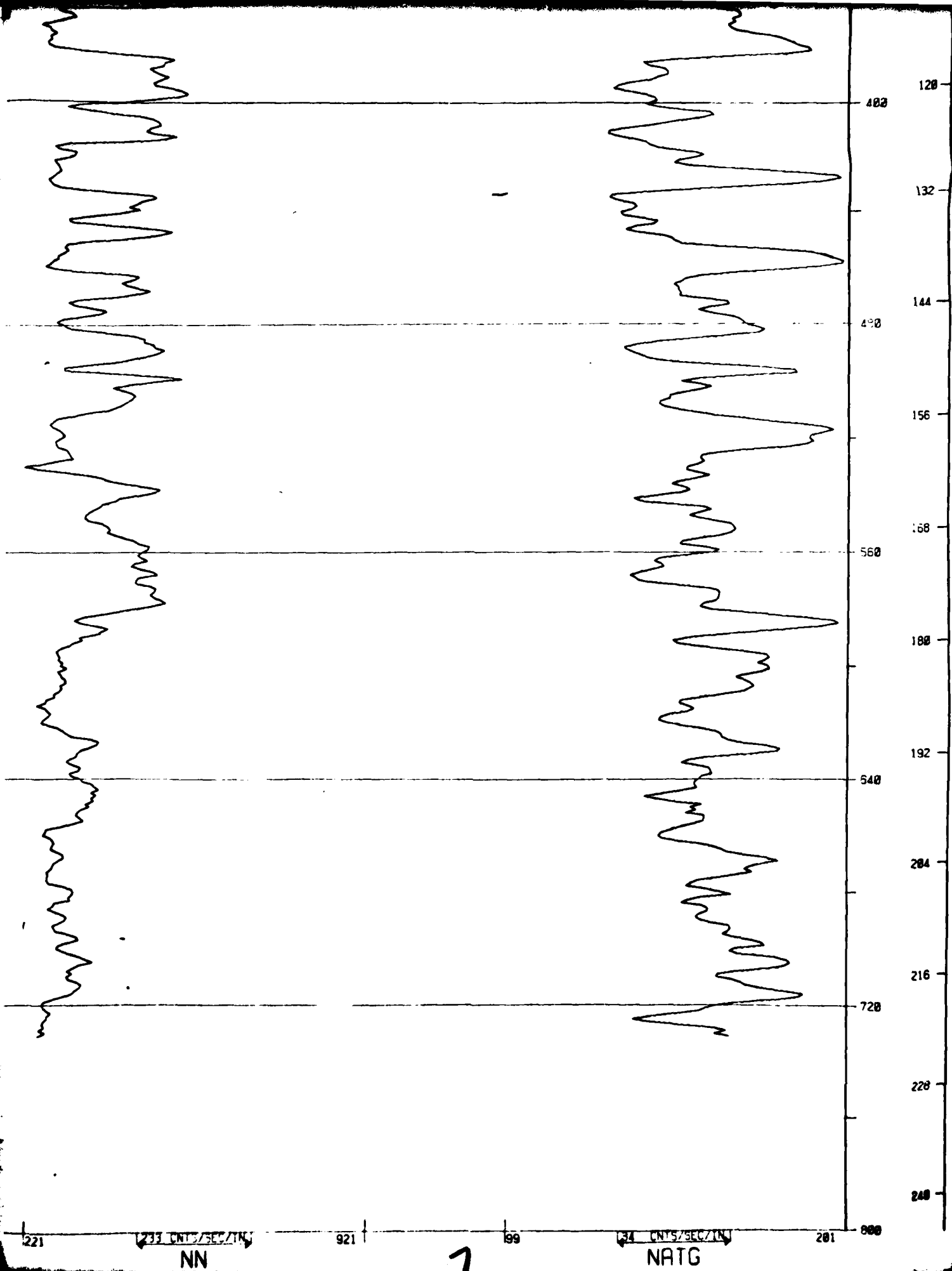
888



117 CM/S/SEC/IN
GM

104 CM/S/SEC/IN
GG





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NUCLEAR GEOPHYSICAL LOGS
BORING LD-D-1
LECHUGUILLA DESERT, ARIZONA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

DRAWING

A-10

FUGRO NATIONAL, INC.

SM

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METERS -

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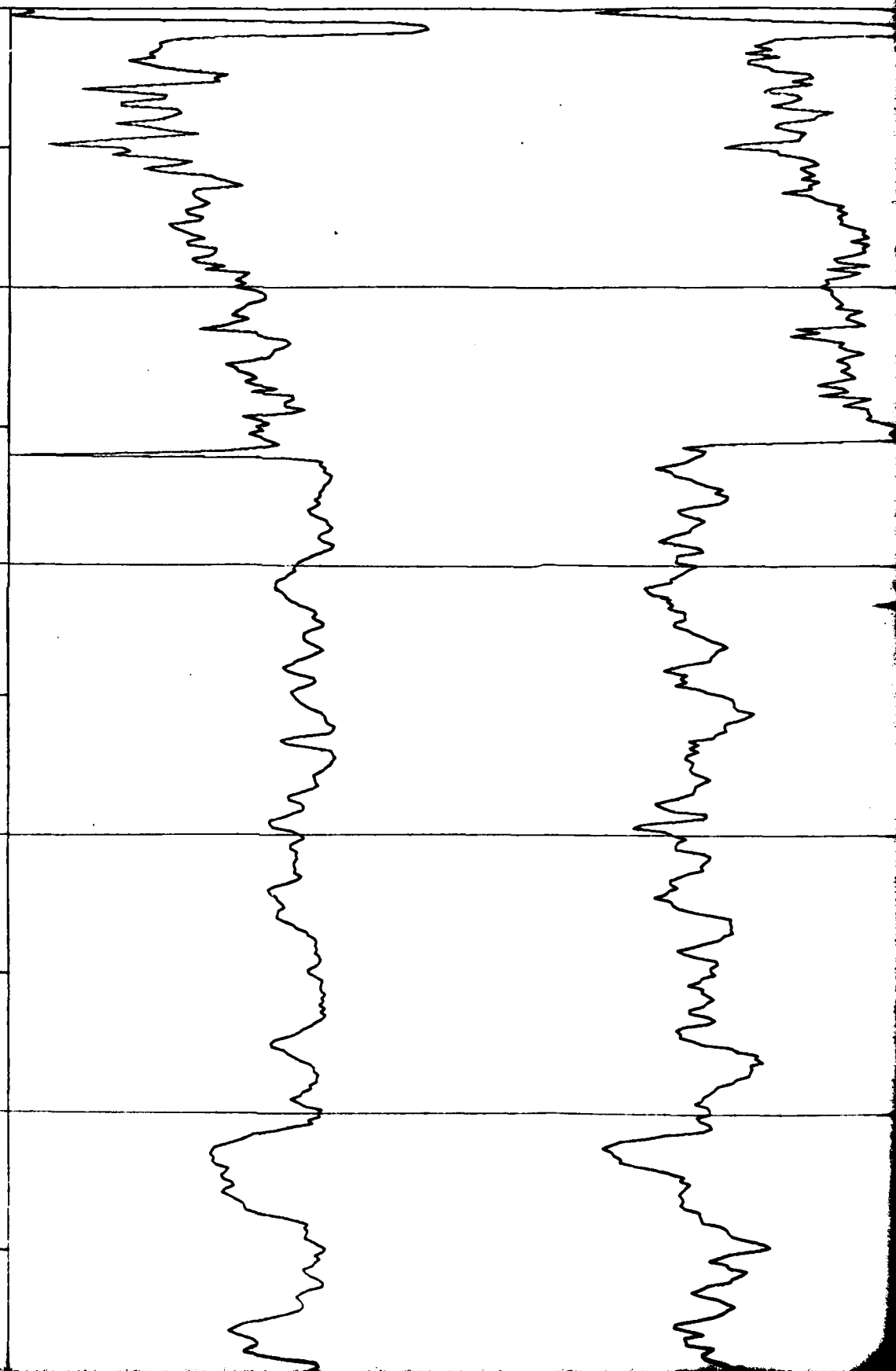
133

84

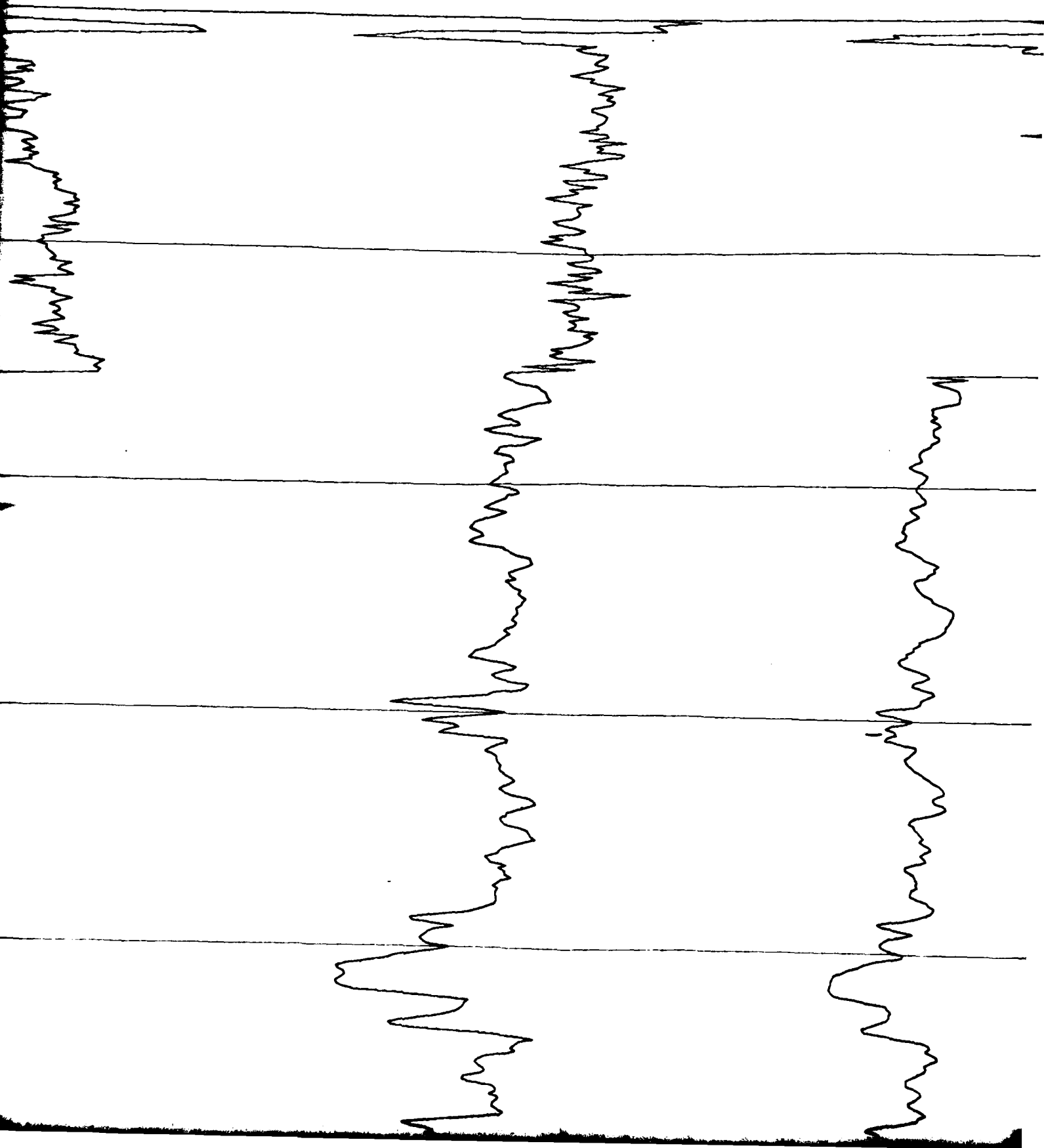
162

248

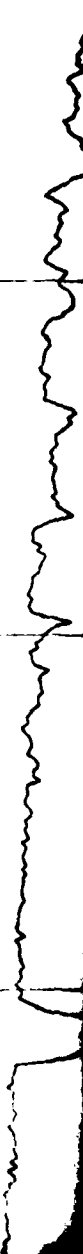
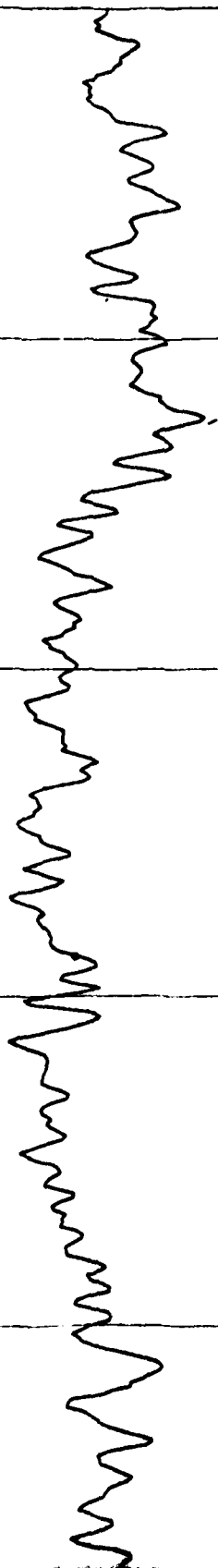
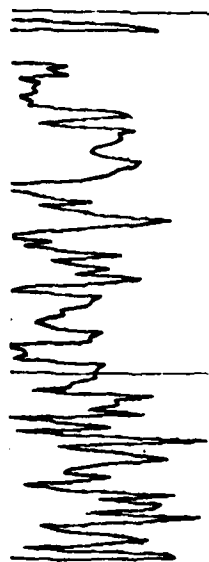
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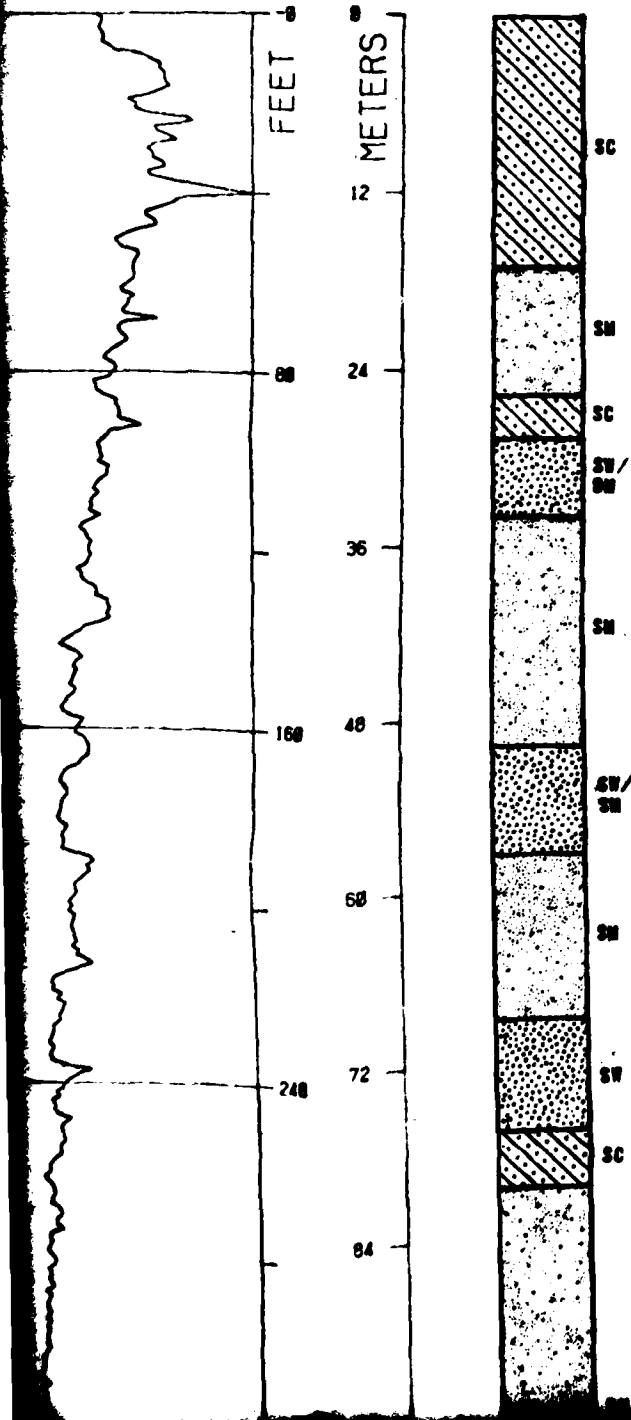
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WASHINGTON STATE UNIVERSITY

COLLEGE OF ENGINEERING

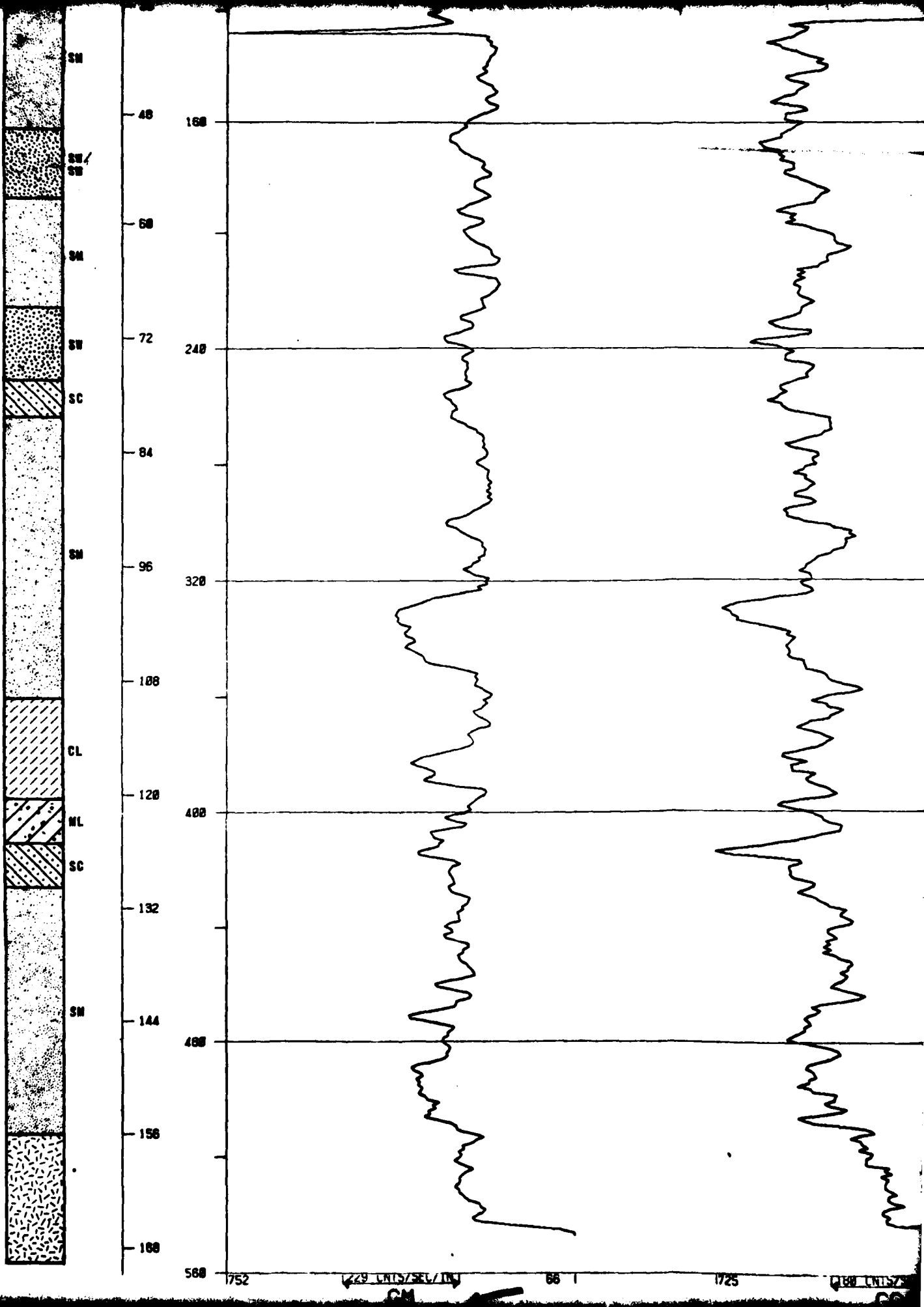
GEOHYDROLOGY SECTION WELL LOG PROCESSING SYSTEM

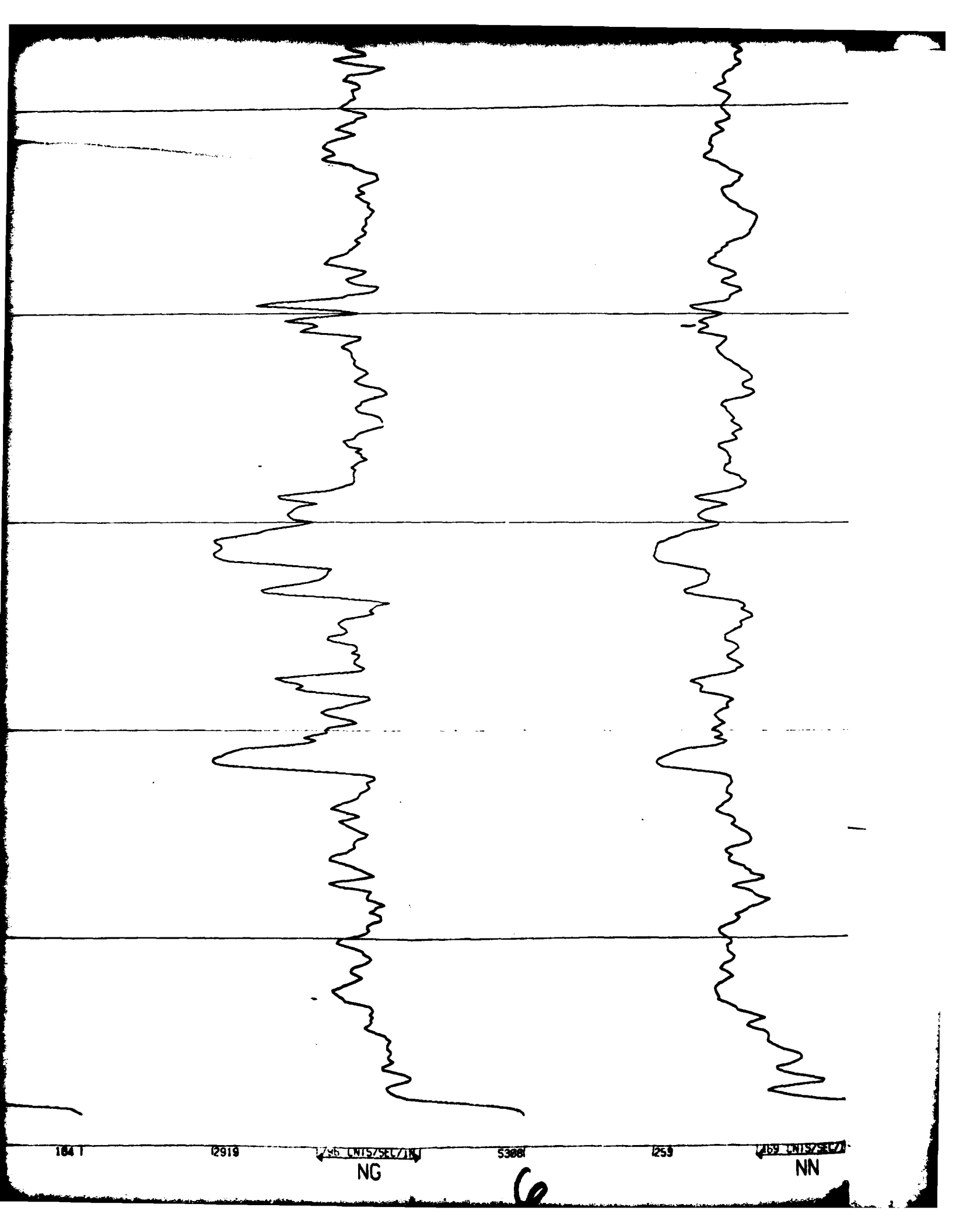
PROJECT NAME AIR FORCE
 BORING NO. 10-8-3
 ELEVATION 888' (268m)
 STATE ARIZONA
 COUNTY YUMA
 STUDY AREA LECHUGUILLA DES.
 DATE LOGGED 5/25/77
 TOTAL DEPTH LOGGED 548' (167m)
 DEPTH TO WATER LEVEL
 REMARKS

EXPLANATION

LOG TITLES

NATG - - NATURAL GAMMA
 GG - - GAMMA GAMMA
 NN - - NEUTRON NEUTRON
 NG - - NEUTRON GAMMA
 FT - - FLUID TEMPERATURE
 FR - - FLUID RESISTIVITY
 CALP - - CALIPER
 SP - - SPONTANEOUS POTENTIAL





1841

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2.56 CM/S/SEC/IN

NG

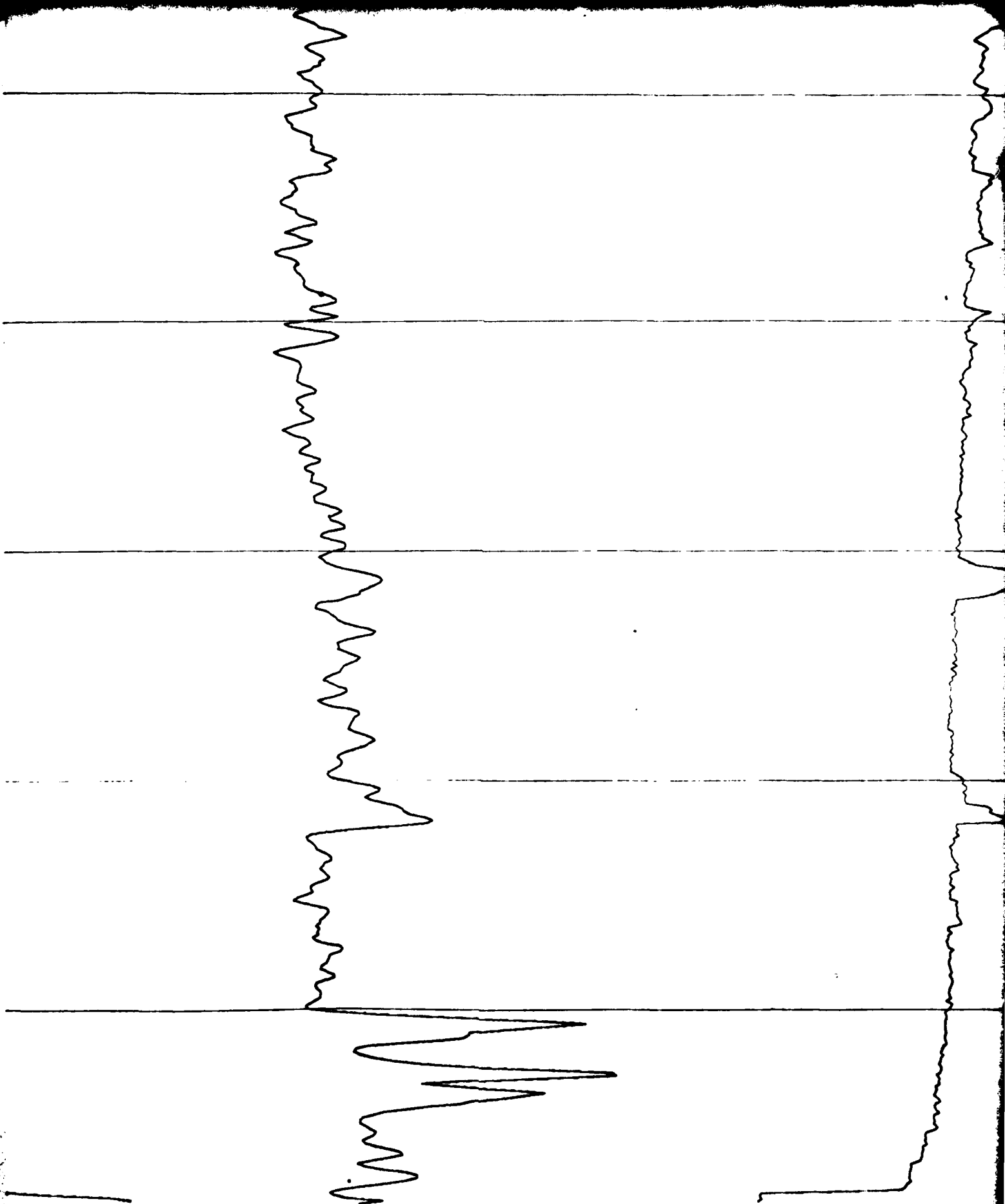
5308

253

4159 CM/S/SEC/IN

NN

6



1659

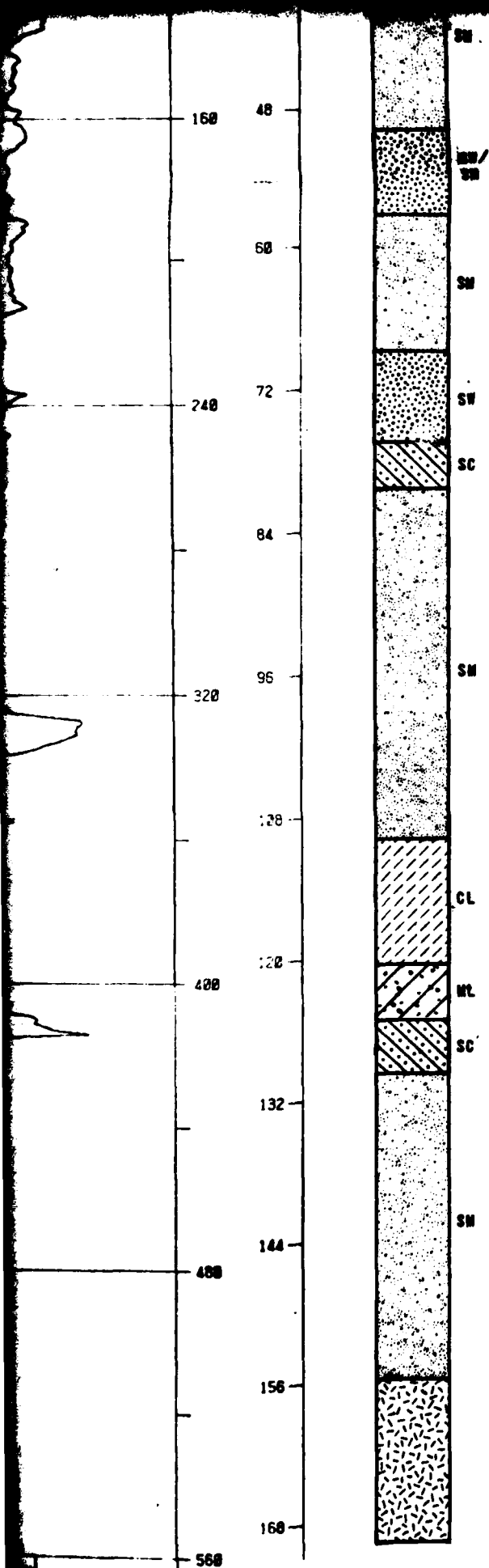
1137

164 UNITS/SEC/IN

NATG

330

5 3/16" CALP 6



ELEVATION 800 (2000)
 STATE ARIZONA
 COUNTY YUMA
 STUDY AREA LECHUGUILLA DES.
 DATE LOGGED 5/25/77
 TOTAL DEPTH LOGGED . . 548' (167m)
 DEPTH TO WATER LEVEL . —
 REMARKS —

EXPLANATION
 LOG TITLES
 NATG - - NATURAL GAMMA
 GG - - GAMMA GAMMA
 NN - - NEUTRON NEUTRON
 NG - - NEUTRON GAMMA
 FT - - FLUID TEMPERATURE
 FR - - FLUID RESISTIVITY
 CALP - - CALIPER
 SP - - SPONTANEOUS POTENTIAL
 WRES - - RESISTIVITY
 FMTR - - FLOW METER
 GM - - DELTA GAMMA
 DENSITY (GG-LOG) INCREASES →
 POROSITY (NN-LOG) INCREASES ←
 WATER LEVEL - - -

NUCLEAR GEOPHYSICAL LOGS BOREING LD-D-3 LECHUGUILLA DESERT, ARIZONA	
MX SITING INVESTIGATION DEPARTMENT OF THE AIR FORCE - SANSO	DRAWING A-12
FURRO NATIONAL INC.	